# Task Analysis - Introduction to the Systematic Search

**Audience**: graduate students, researchers, faculty

**Purpose:**

* This content provides an outline of the steps involved in the development of a systematic search strategy, applicable within academic research databases
* Activities undertaken throughout the module will guide researchers through the initial steps in building their own search strategy. Librarians can refer patrons to this tool, prior to attending a research consultation. At the end of the module, researchers have the option to complete an activity handout which they can use for their own purposes or which can be used for a research consultation with a subject librarian.
* We have indicated areas in which we recommend the module link out to supplemental content.

# List of Tasks:

1. Introduction to the Systematic Search Module
2. What makes a search “systematic”?
3. Formulating a research question
	1. Models for formatting research questions

Outline of the elements of the research question

1. Preliminary search process.
2. Developing the search strategy
	1. Identify main concepts
	2. Develop search terms – author keywords.
		1. Organize search terms using the Concept Table
	3. Develop search terms- database subject headings.
		1. Organize search terms using the Concept Table
	4. Combining search terms
	5. Testing search terms
3. Conclusions
4. Further Help

# Breakdown of Tasks:

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| --- | --- | --- |
| Module | Specific Task | Assessment |
| 1. Introduction to the Systematic Search Module | Welcome to the Systematic Search Module.This module provides an overview of the main elements of a systematic search strategy.* You will learn techniques which can be used to build your own systematic search.
* After completing the modules, you will understand the components of a systematic search for a focused research question.
 |  |
| 2. Systematic search methods | Systematic literature searching is performed is performed in certain forms of knowledge syntheses, such as systematic and scoping reviews, systematic literature reviews, rapid reviews or any form of literature review which desires a systematic approach to identifying relevant evidence. It is not an appropriate search technique for more general literature reviews in which the purpose is to identify selected and/or key papers.Keys stages in developing systematic search methods include:Stage 1: Preliminary searching: identify existing reviews and determine the extent of published research on the topicStage 2: Developing search strategy: identify key search termsStage 3: Database searching: select multiple, complementary databases and implement search strategyStage 4: Supplementary searching: conduct techniques such as searching grey literature, reviewing reference lists, and handsearching to identify studies missed in database searchingStage 5: Managing the references: remove duplicates and organize results for screening Stage 6: Reporting the search process: document and report the search methods using standard guidelines, when availableAdapted from: Cooper, C., Booth, A., Varley-Campbell, J., Britten, N., & Garside, R. (2018). Defining the process to literature searching in systematic reviews: A literature review of guidance and supporting studies. BMC Medical Research Methodology, 18, 85. https://doi.org/10.1186/s12874-018-0545-3This module focuses on Stage 2. Developing search strategy |  |
| 2. 1 What makes a search ‘systematic’? | Characteristics of systematic search methods include the following:* A systematic search is comprehensive and exhaustive. The intent is to capture ALL published evidence. You can expect to retrieve and screen hundreds, if not thousands, of database search results.
* A systematic search method involves only ONE search strategy per database. All relevant search terms are combined into one single strategy. The results from this single search are then screened for relevant papers.
* A systematic search is transparent and reproducible. Full search strategy details are reported such that a reader can implement the exact search and retrieve similar results.
* Developing the systematic search strategy can be a long, iterative process involving many stages of development. It can take several weeks, if not months, to prepare and should involve consultation with members of the review team or colleagues.
 |  |
| 3. Formulating a research question | A systematic search strategy is based on a well-developed, targeted research question. The research question must be clear and focused. A systematic search approach is not appropriate for a broad, background research question. |  |
| 3.1 Models for formatting research questions  | Several models have been developed to help guide the development of a focused, precise research question. A poorly structured question will lead to disorganized and unproductive searches of the literature.* PICO (useful for quantitative review questions): Population/Patient, Intervention (or Exposure), Comparison/Control, Outcome. Additional PICO elements include: S: Study designs or setting, T: timeframe (citation: Richardson, W. S., Wilson, M. C., Nishikawa, J., & Hayward, R. S. (1995). The well-built clinical question: a key to evidence-based decisions. ACP J Club, 123(3), A12-3.)
* PCC: Participant/Population, Concept/Intervention, Context/Setting (does not incorporate specific outcomes or interventions) (citation: Aromataris E, Munn Z (Eds)*. Joanna Briggs Institute Reviewer's Manual.*The Joanna Briggs Institute, 2017. Available from <https://reviewersmanual.joannabriggs.org/> )
* SPICE: Setting (where? the context for the question), Perspective (for whom?), Intervention (what? the action taken), Comparison (what are the alternatives?), Evaluation (what results or how well?) (citation: Cleyle, S., & Booth, A. (2006). Clear and present questions: formulating questions for evidence based practice. *Library hi tech. 24*(3), 355-368)

**Outline of the elements of the research question**~~Or maybe move these examples directly under the description in 3.1~~Using a table format to outline the elements of the research question will help to guide the subsequent search strategy development. Focus on the main concepts within each element of the research questionExamples: PICO (S) table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Population characteristics | Intervention | Comparison | Outcomes | Setting |
| Indigenous | Youth (ages 5-18) | Sports programs | None | Mental health and well being | Canada |

PCC

|  |  |  |
| --- | --- | --- |
| Population  | Concept/Intervention | Context/Setting |
| Women | Food security | Developing countries |

SPICE table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Setting | Perspective | Intervention | Comparison | Evaluation |
| Low income countries | Public health units | Vaccine programs | None | Cost analysis |

 |  |
| 4. Preliminary search process | Before developing a systematic search strategy, it is important to first browse the literature within the research field to gain a sense of the breadth of information available. Ask yourself questions like “Is there enough/too much literature on my topic?” Does my question need to be revised/narrowed? You may find that you will adjust your research question based on the amount (of lack) of research on the topic.Ideally, during this preliminary stage you should be able to identify several primary research articles which address all elements of your research question. These papers will be used as benchmark articles in the next stage of the search term development process.*Activity*:Using articles you have already collected on your research topic or through searching your favourite academic database, * **Identify 2 primary research articles** which address the research question
* **Identify 2 systematic review** **articles** which include the published search strategies.
 |  |
| 5. Developing the search strategy | The goal of systematic search methods is to develop one final search strategy per academic research database, containing all relevant search terms needed to retrieve the evidence related to the research question. The number of results retrieved in this final search strategy are recorded and then records are screened for inclusion in the review.   |  |
| 5.1 Identify main concepts | The first step in developing the search strategy is to identify which main concepts from the research question to include in the search. Note, you do not need to include all the elements from the research question. It is up to you, as a searcher, to identify which concepts from the search strategy will yield the best search results. The concepts are organized into a search term table to guide the organization of the search strategy.Search term table:

|  |  |  |
| --- | --- | --- |
| Concept 1 | Concept 2 | Concept 3 |
| Indigenous | Youth | Sports  |

*Activity:* Develop a search term table for the elements of the research question you plan to include in your own search strategy*We should create a handout to guide students through this activity. There is an example on the Public Health research guide.* | See two assessments below table |
| 5.2 Develop search terms – author keywords | For each concept, develop a list of synonyms or alternate terms authors may use to describe the concept. Different researchers may use different terminology and some articles may be missed if not all relevant, alternative terms are included in the search.**Steps to assist in identifying additional author keywords** include:1. Brainstorm with colleagues, other members of the research team
2. Review titles/abstracts/author keywords of related papers identified in preliminary searching or recommended by colleagues

Review search strategies in published review papers to learn what terms other authors have used in systematic search strategies |  |
| 5.2.1 Organize search terms using the Concept Table | The author keywords are organized using the Search Term Table. When creating the list of search terms, consider differences in American and English spelling, plurals, alternate word endings, abbreviations, split or hyphenated terms

|  |  |  |  |
| --- | --- | --- | --- |
|  | Concept 1 | Concept 2 | Concept 3 |
| Author keywords | IndigenousAboriginalFirst nationsMetis | YouthTeensTeenagers | SportsSportAthleticsAthletesHockey |

*Activity:* Add several author keywords to each element in your Search Term Table. |  |
| 5.3 Develop search terms- database subject headings | Database subject headings are a second type of search term expected in systematic search strategies. Many (although not all) academic databases assign or ‘tag’ their own unique subject headings (also known as index terms, descriptors) to article records to describe the content of the article. It is important to include both subject headings (when available) and author keywords in a search strategy to be as comprehensive as possible.**Steps to assist in finding subject headings** include:1. Find a relevant record in the database – review the assigned subject headings
2. Review the database’s thesaurus of subject headings
3. Review search strategies in published review papers to learn what headings other authors have used in their search strategies
 |  |
| 5.3.1 Organize search terms using the Concept Table | The subject headings are added to the Search Term Table, when appropriate. Subject headings are unique to each database therefore a different table will need to be developed for each database search strategy. *Perhaps include images or screenshot or video of where/how to find the MeSH in a PubMed record?*Search Term Table (Note, this example includes subject headings for MEDLINE/PubMed database)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Concept 1 | Concept 2 | Concept 3 |
| Author keywords | IndigenousAboriginalFirst nationsMetis | YouthTeensTeenagers | SportsSportAthletics |
| Medical subject headings (MeSH) | Indigenous PeoplesIndians, North American | Adolescent | SportsHockey |

*Activity:* If the database you are using applies subject headings, add relevant headings to your Search Term Table |  |
| 5.4 Combining search terms | The final stage is to combine all the search terms into one search strategy. This is accomplished using the AND/OR/NOT operators.* OR is used to combine the synonyms or alternate terms for the same concept. An article may contain any of the terms in the list.
* AND is used to join different concepts. An article must contain at least one terms from every concept.
* NOT is used to exclude terms from the search results. You may want to exclude terms from the results, for example, NOT adults. However, this technique has the potential to exclude relevant articles and it is not typically recommended for systematic search strategies.

*We would like to link out to a useful video or other module for further information on Boolean operators.*Search Term Table with search operators

|  |  |  |  |
| --- | --- | --- | --- |
|  | Concept 1 AND | Concept 2 AND | Concept 3 |
| Author keywords | IndigenousORAboriginalORFirst nationsORMetisOR | YouthORTeensORTeenagersORAdolescentsOR | SportsORSportORAthleticsOR |
| Medical subject headings (MeSH) | Indigenous PeoplesORIndians, North American | Adolescent | SportsORHockey |

Guided by the table, the search terms are connected to form one single search strategy. Each set of alternate terms are combined within a set of parentheses or round brackets:(indigenous OR aboriginal OR first nations OR metis OR indigenous peoples OR Indians, North American) AND (youth OR teens OR teenagers OR adolescent) AND (sports OR sport OR athletics)or using an Advanced search screen (if available in database)indigenous OR aboriginal OR first nations OR metis OR indigenous peoples OR Indians, north AmericanANDyouth OR teens OR teenagers OR adolescentANDsports OR sport OR athletics*Perhaps include images or screenshots of the PubMed search screen or a brief video of how to implement this search?**Activity:* Combine the search terms from your Search Term Table into one search strategy and run the search in the database. | See assessment below table |
| 5.5 Testing search terms | Building a search strategy is an iterative process. You will try and test different terms, looking at the relevancy of the results to determine if search terms should be added or removed from the search. To test the search:* The final search strategy should retrieve the known articles, those you have found during the preliminary search exercise. If not, look through the articles to determine if you are missing any relevant search terms.

The final search results should represent a balance between recall and precision. You want the search results to be expansive enough that they include all relevant articles on the topic (high recall) but precise enough that you do not retrieve a high number of irrelevant papers (high precision).The final number of results retrieved in your search strategy need to be manageable within the timeline and workload of the project*Activity:*How many results were retrieved with your search strategy? Too many, too few? Do you need to adjust your search?  |  |
| 6. Conclusions | You have now built a systematic search strategy. You may wish to address a few additional search techniques not covered in this module such as truncation, proximity operators, and search fields. These techniques will be addressed in each database’s help materials.More information on database selection and searching techniques can be found in the subject specific research guides:* [School of Public Health and Health Systems and Kinesiology Research Guide](https://subjectguides.uwaterloo.ca/c.php?g=695410&p=4932740)
* [Pharmacy Research Guide](https://subjectguides.uwaterloo.ca/c.php?g=695509&p=4933476)

*Perhaps there are supplemental videos/materials we could link to?* **Key Takeaways**1. A systematic search is built around a clear, focused, and precise research question.
2. A search strategy consists of author keywords and database subject headings (when available)
3. Organized through the search term concept table, search terms are combined to form one search strategy per database.
4. Building a systematic search strategy is an iterative process testing keywords until an appropriate balance of recall and precision has been reached.
 |   |
| 7. Further Help | Need further help? For more details on the types of support offered through the Library, review the webpage: <https://uwaterloo.ca/library/research-supports/systematic-reviews-support> |  |

**Assessments:**

**Section 5.1**

Assessment #1. In your opinion, select the concepts which should be included in the search terms table developed for the published review paper given below. Focus on the elements in the research question model which best fits the topic, i.e. PICO, SPICE, etc.

*Physical activity interventions to promote positive youth development among indigenous youth: a RE-AIM review*

1. Physical activity interventions (yes, this is the intervention of the research question. Often the word ‘interventions’ is left out of the search strategy as it is implied in the topic. For instance, the authors of this paper only included search terms for physical activity or sport in their search strategy with no intervention or program terms)
2. Promote (no, this concept does not fit into any of the elements of the research question models)
3. Positive youth development (yes, this is the outcome of the research question. Some searchers may choose to exclude the ‘positive’ aspect from the search strategy. This will ensure that studies which report negative outcomes will still be retrieved, leading to a less biased set of results)
4. Indigenous (yes, this is the population of the research question)
5. Youth (yes, this is a population characteristic of the research question)

General feedback: The authors chose to include the following concepts in their search strategy: physical activity AND positive development AND Indigenous. They did not include Youth as a search concept and therefore chose to read all the search results to identify studies which this population characteristic instead.

|  |  |  |
| --- | --- | --- |
| Physical activity | Positive development | Indigenous peoples |
|  |  |  |

For full search strategy, see the Methods section of the published article at <https://link-springer-com.proxy.lib.uwaterloo.ca/article/10.1007/s13142-016-0428-2>)

Assessment #2. In your opinion, select the elements which should be included in the search term concept table for the search strategy developed for the published review paper given below. Consider which research question model best fits the research question (PICO, SPICE, etc) and focus on these elements.

*The effectiveness of re-employment programmes for unemployed persons with severe mental health problems on health and quality of life: A systematic review and meta-analysis*

1. Effectiveness (no, this is not an element within the research question model. Including this term in a search strategy may also exclude ‘ineffective’ studies leading to a biased set of search results)
2. Re-employment programmes (yes, this is the intervention of the research question)
3. Unemployed persons (maybe, this is the population of the research question. Some searchers may choose to exclude this concept from the search strategy as this population is implied as a participant in an ‘re-employment’ intervention program, i.e. all participants must be unemployed to participate in the intervention)
4. Mental health problems (yes. this is a population characteristic)
5. Health (yes, this is an outcome of the research question. Pay special attention to how the outcomes are arranged in the search term table. The authors want to retrieve studies which measure health and/or quality of life outcomes, even through the questions is worded using AND. Therefore these outcomes are collected in the same column of the search term table.)
* Quality of life (yes, this is an outcome of the research question. Pay special attention to how the outcomes are arranged in the search term table. The authors want to retrieve studies which measure health and/or quality of life outcomes, even through the questions is worded using AND. Therefore, these outcomes are collected in the same column of the search term table.)

General feedback: The authors chose to include the following concepts in their search strategy: (health OR quality of life) AND re-employment programs. They also included a limit for specific study designs including randomized controlled trials, cohort studies, and longitudinal studies. The authors did not include mental health as a search concept and therefore chose to read all the search results to identify studies which this population characteristic instead.

|  |  |  |
| --- | --- | --- |
| Health or quality of life | Re-employment programs | Study designs |
|  |  |  |

See the full search strategy at <https://oem-bmj-com.proxy.lib.uwaterloo.ca/content/oemed/suppl/2016/01/06/oemed-2015-103121.DC1/oemed-2015-103121supp.pdf>

**Section 5.4**

Multiple choice assessment: From the search strategies below, select the most logical and efficient combination of AND and OR to find relevant studies related to the research topic: **negative outcomes from** **using a phone or texting while driving**

1. (using a phone while driving) OR (texting while driving) (no, the concepts have not been appropriately isolated from the research question, they have been left in the format of the research question)
2. (driving) AND (phone OR distracted OR texting) (yes, correct use of AND, OR and round brackets)
3. driving AND phones OR texting OR distracted (no, round brackets are needed to surround the phone synonyms)
4. (distracted AND phone AND texting) AND driving (no, the OR operator should have been used within the round brackets)

General feedback: Answer b is the correct answer and illustrates appropriate use of AND, OR and round brackets: (driving) AND (phone OR distracted OR texting). It is the search strategy with the highest recall and will retrieve the most variances in how authors describe this topic. Answer a is the search strategy with the highest precision. Almost all of the articles retrieved will be precisely on the topic of the research question, but many papers will be missed in the search results by authors using alternate phrasing. **Systematic search methods favour high recall** to ensure that all relevant studies will be retrieved in the search results