Before You Search the Literature: How to Prepare and Get the Most Out of Citation Databases

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As evidence-based practice becomes more integrated into routine care, systematically searching of the literature is essential to making informed clinical decisions. To uncover all the evidence and get the most unbiased sense of what is known about a particular phenomenon or caregiving practice, a clear method of searching that is systematic is needed. This article provides a discussion of six steps in a systematic search: (1) constructing the question, (2) choose the appropriate database(s), (3) formulate a search strategy, (4) perform the search, (5) evaluate the results, (6) good results (answer the question) = use the search information, (7) bad results = start over (refine the search strategies). Tips for working with a librarian are also provided. Lastly, a checklist developed to facilitate the steps of the searching process is discussed and provided for use by readers. Nurses are not trained to systematically search the literature, yet evidence-based practice demands that nurses and all health professionals be familiar with the searching process, especially when making evidence-based caregiving decisions.

Keywords: Literature searches; Integrated reviews; Systematic reviews; Citation databases

As evidence-based practice becomes more integrated into routine care, systematically searching the literature is becoming more than just for academics. Access to the most recent evidence is essential to making informed clinical decisions. However, do bedside caregivers have the tools to make systematic searching easy? Searching can begin with a quick 5-minute search using Google or typing a phrase into PubMed, but that cannot be the end; if the best most comprehensive evidence is needed to make clinical decisions, the search process must also be systematic and comprehensive. To uncover all the evidence and get the most unbiased sense of what is known about a particular phenomenon or caregiving practice, a clear method of searching that is systematic is needed.

Systematic reviews and integrated reviews are now commonplace in the literature, yet neither can be accurate or comprehensive without *first* completing a systematic search. Choosing the right databases and formulating a search strategy composed of the proper key words and subject headings are important to a good outcome.[1,2] This article will begin by first considering the steps that go into a systematic search and then provides more detail about how to best accomplish each step. We also provide tips for working with a nursing or medical librarian. Given the movement toward evidence-based practice, librarians must be true collaborators with bedside caregivers. Lastly, we provide a checklist developed to facilitate the steps of the searching process. Details of completing a systematic review are beyond the scope of this article; we chose to focus our work on solely the searching process.

Nurses are not trained to systematically search the literature, yet evidence-based practice demands that nurses and all health professionals be familiar with the searching process, especially when trying to make the best evidence-based caregiving decisions. No one person can keep up with the amount of new literature becoming available almost on a daily basis. It has been estimated that in 2012 alone, more than 500 000 articles will be added to the existing health care literature.[1,2] If that number is correct, that would mean that one would need to read almost 1370 articles daily—an impossible feat and that's only staying abreast of the new literature and assuming you have a handle on the existing literature. However, becoming familiar with a routine of systematic searching, which includes selecting the right databases, key words, and subject headings, can help practicing nurses stay on top of the latest research. This, in turn, will help them to develop best caregiving practices surrounding a particular population or topic of interest.

Background

Increasingly, nurses and other medical professionals use the Internet to find information. Many turn to search engines like Google to find this information without realizing that there are other resources available that can provide better, more

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comprehensive results. For nurses, two databases that are particularly useful are PubMed and Cumulative Index to Nursing and Allied Health Literature (CINAHL).[3] These databases enable a user to more effectively search the literature on a topic because they both use a controlled vocabulary in the form of subject headings. Each database has its own list of subject headings, MeSH for PubMed and CINAHL Headings for CINAHL. There are similarities in the words chosen as subject heading within each of these databases, but the differences stem from the audience each is meant to address. PubMed is intended to be a resource to search all biomedical literature, whereas CINAHL is intended to be for literature addressing nursing and allied health. The headings are similar in that each uses a hierarchical structure that starts with the broad topic with each subsequent term below it being more specific. These lists are updated on an annual basis to address the changing foci of the current literature.[4]

It is important to know that articles included in each database are reviewed by a group of indexers who are specially trained to evaluate and assign the proper subject headings. In addition to key words chosen by the author or journal editor, each article is assigned an average of four headings that are designated major headings, which highlight the main subjects discussed by the article.[4] Indexers assign the subject heading based on a policy that requires that they use the most specific heading available.[5] An indexer will also assign subheadings that further allows a person searching to focus on a certain aspect of a topic that is addressed; these are often database specific.[3] Along with these subheadings, publication types (ie, meta-analysis, systematic reviews, randomized control trials, etc) and check tags are assigned. Check tags include items such as age group, human, animal, sex, and language that users can select as limits when searching either database.[5] Although this article will not go beyond the process of preparing for and planning the search, there are several resources available for helping you become more familiar and comfortable with using bibliographic databases. These can easily be found by visiting each of the databases online and checking out their help pages. There are also many great videos available on the Internet with step-by-step guides for helping you to use bibliographic databases. In addition, the more often a health professional uses a citation database, the more likely they will become comfortable with this valuable resource. Time and practice do make perfect! Most medical libraries offer classes in using bibliographic databases, and time spent with the librarian is invaluable in perfecting these skills.

Steps in the Systematic Searching Process

There are several steps to the searching process. It is important to know that a good search can seldom be completed in one sitting or a short period. There are nuances to the databases and the searching process that make the process a little more complex. In addition, the complexity of the process requires planning before the true searching can begin.[6,7] We propose six steps, and we will outline aspects of each of these steps: (1) problem/construct the question, (2) choose the appropriate database(s) or resources for the topic, (3) formulate a search strategy, (4) perform the search, (5) evaluate the results, and (6) good results (answer the question) = use the data, bad results = start over (refine the search strategies) (see Fig 1). In addition, at the end of this article, we have provided a worksheet for searching the literature (see Fig 2).

Roy Brown (nursing librarian and coauthor) created the Search Process Checklist to facilitate database searching for nursing students and practicing nurses. He found that both

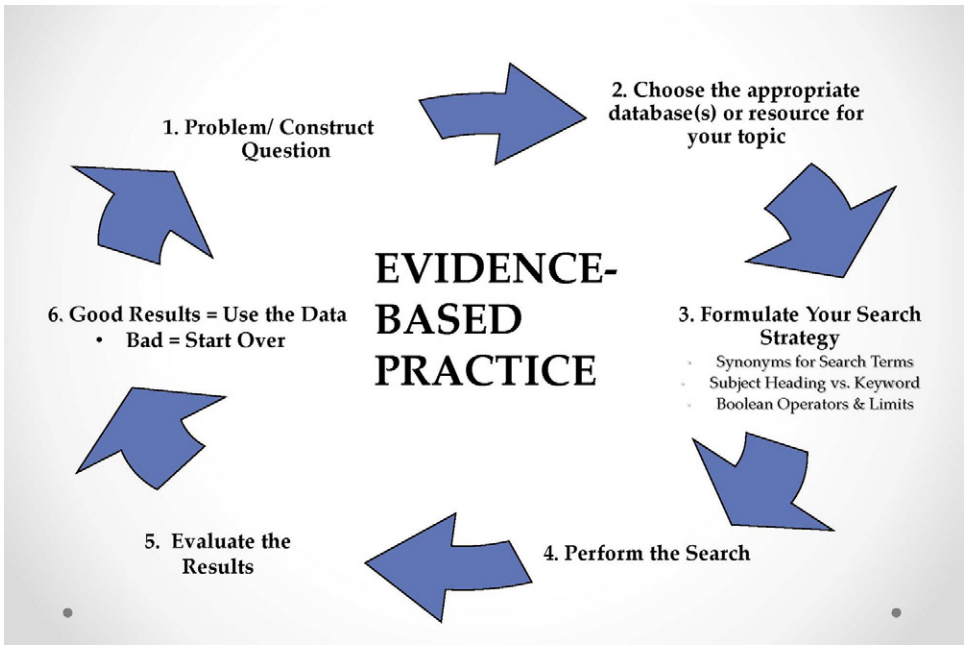

Fig 1. Steps in the systematic search process.

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Search Process Checklist

✓ **Problem/Issue/Question:**

✓ **PICO (*not applicable in all situations*)**

PICO Components	Describe PICO Components
P – Patient, Population, Problem, Program Important Characteristics	
I – Intervention Drug/treatment, diagnostic/screening test, exposure, etc.	
C – Comparison Intervention (If Applicable) Alternative being considered (placebo, std. therapy, no treatment, gold standard)	
O – Outcome What to measure, accomplish, improve, affect (reduced mortality/morbidity, improve quality of life, accurate & timely diagnosis)	

Dartmouth Biomedical Libraries. *Clinical question worksheet.* Retrieved 3/12/2012, from http://www.dartmouth.edu/~biomed/services.html/EBP_docs/clin_question_worksheet.pdf

✓ **Restatement of question using PICO components:** (Needs to be answerable/measurable question)

✓ **Search Terms/Concepts:**

	Primary Search Term	Synonyms/ Related Concepts
P		
I		
C		
O		

✓ **Limits to be Applied:**

Gender: ____ Male ____ Female **Species:** _____ Humans _____ Animals	**Age Groups: (*may differ by database*)** ____ All ages ____ Newborn (<1 month) ____ Infant (1-23 months) ____ Pre-School (2-5 yrs) ____ Child (6-12 years) ____ Adolescent (13-18 years) ____ Adult (19-44 years) ____ Middle aged (45-64 years) ____ Elderly (65-79 years) ____ Aged (>80 years)
Years to be Covered:	**Languages: English Only** **Other Languages: _____**
	Types of Literature/Studies to Include:

Fig 2. Search process checklist *(PDF versions of Figure 2 available by contacting the author).*

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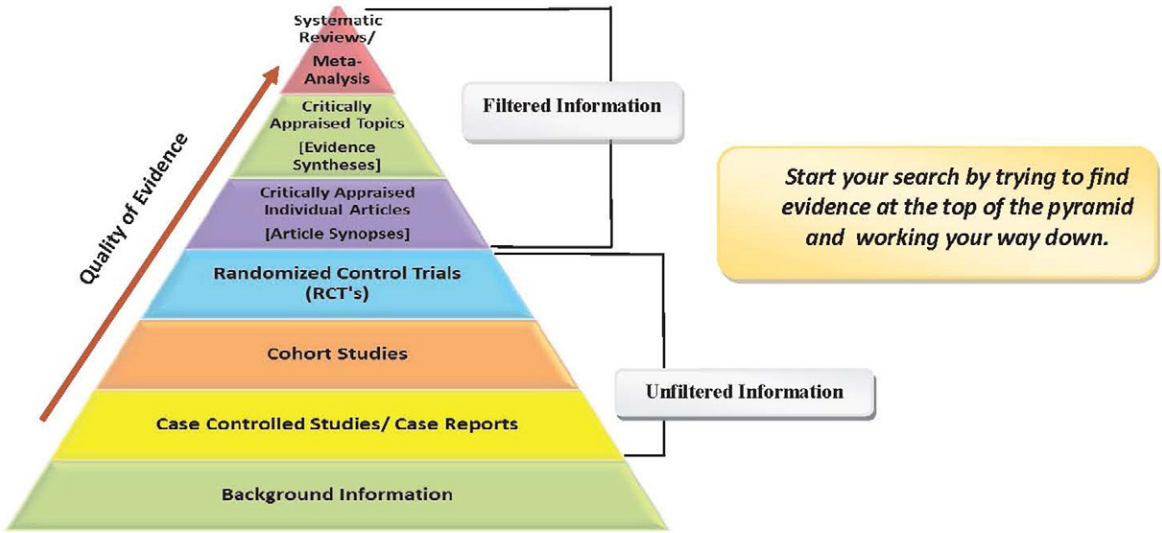
Search Process Checklist

✓ **What types of study designs should be included in the search?**



♦ **The type of question can help determine the type of study one should search for:**

Type of Question	Best Type of Study
Therapy	**Randomized Control Trial (RCT)**
Prevention	**RCT/ Cohort Study / Case Control**
Prognosis	**Cohort Study/ Case Control/ Case Series or Case Report**
Diagnosis	**Blind RCT Compared to the Gold Standard (*best treatment/test for diagnosis*)**
Etiology/Harm	**RCT/ Cohort Study /Case Control**
Cost analysis	**Economic Analysis**

Dartmouth Biomedical Libraries. *Clinical question worksheet.* Retrieved 3/12/2012, from http://www.dartmouth.edu/~biomed/services.html/EBP_docs/clin_question_worksheet.pdf

♦ **Studies or Literature Sources To Include**

____ Systematic Review ____ Meta-Analysis ____ EBM Practice Guideline ____ Review Article ____ Economic Analysis	____ Randomized Controlled Trials • Clinical Trials ◊ Clinical Trials, Phase I ◊ Clinical Trials, Phase II ◊ Clinical Trials, Phase III ◊ Clinical Trials, Phase IV	____ Cohort Study • Twin Studies • Prospective Cohort Study • Retrospective Cohort Study ____ Case Report / Case-Control Study ____ Background Info./Expert Opinion

✓ **Databases Searched**

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

Fig 2. continued.

✓ **Known Authors/Researches in the Field**

1)

2)

✓ **Relevant Citations:**

Authors_____ Title_____

Source Title _____ v. _____ no. _____ date _____

Authors_____ Title_____

Source Title _____ v. _____ no. _____ date _____

- *If you find a good article, search for it in PubMed, CINAHL or another database that has a controlled vocabulary and see how it is indexed. This will allow you to find terms that may be useful to find articles on the same topic.*

✓ **Useful Terms in Databases Searched (Controlled Vocab Terms & Keywords)**

Database/Source #1	Database/Source #2	Database/Source #3

- **Search Record:**

Database #1 _____ _____Period covered _____ Date searched _____

Database #2 _____ _____Period covered _____ Date searched _____

Database #3 _____ _____Period covered _____ Date searched _____

Notes:

Fig 2. continued.

groups did not always understand how to best prepare to search the literature or work with a librarian, so he created the checklist as a means to better support both the students and nurses in their thinking about how to systematically search for evidence. We will refer to the checklist as we describe the steps in the systematic searching process in the next several sections. Working with a librarian can be frustrating if the health professional is not prepared for the work session because they can leave the session without completing the search to their satisfaction. Coming prepared can make the session go more smoothly and *possibly* completing the systematic search in one session, although that is often not the case. Systematic searching is complex and does take an investment in time and critical thinking to obtain the best results. Remember, systematic searching leads to comprehensive systematic reviews of the literature and best evidence-based practice. The Searching Process Checklist has been designed to help the nurse keep useful notes about the searching process as well as refine the search. Table 1 provides some general tips about how to best prepare for a work session with a librarian. It is important to remember that preparation done before the session increases the potential for better searching outcomes and less frustration.

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Tips & Reminders

	Advantage	Disadvantage
Controlled Vocabulary *(Subject Heading)*	• A list of subject terms may help you find an appropriate search term for your topic. • It can provide you with suggested terms for narrower, broader or suggested topics. • Using appropriate subject headings for a topic, will retrieve all items in the database indexed under the topic.	• Recently coined terms, including new topics and jargon may not yet be included in the list of subject terms. • When a database does not provide a thesaurus or list of subject terms, the controlled vocabulary might not be obvious.
Keyword	• Will retrieve items containing new terms, distinctive words, jargon. • If you do not know the appropriate subject heading, descriptor or identifier for your topic, you can conduct a key word search first and look at a relevant item for the appropriate subject term.	• You may retrieve items that are not relevant to your topic (*false hits*). • In order to retrieve more relevant items, you need to use a variety of terms. For example, to retrieve items about movies, a keyword search must include terms like *films*, *cinema*, and *motion pictures*.

Florida International University Libraries. *OASIS: Keyword vs. controlled vocabulary or subject searching* Retrieved 3/12/2012 from https://oasis.fiu.edu/Ch3/IA4b.html

♦ Things to Keep in Mind

- ◊ **Keep Concepts Separate –** *This will make it easier to manipulate your search to get desired results.*
- ◊ **Always come up with synonyms for your search terms/concepts as you never know how a database may have a useful article indexed or listed.**
- ◊ **Use Subject Headings/Controlled Vocabulary Whenever Possible. Complete search many times will be a combination Subject Heading & Keyword search.**
- ◊ **Start your search broad and then make it more focused as you see what is in the literature.**
- ◊ **Never hesitate to adjust your search strategy once you evaluate your results**

Searching for a Few Highly Relevant Articles	Not Finding Much, But Want to Be Comprehensive As Possible
◊ Do not explode	◊ Explode whenever possible
◊ Restrict subject heading to major focus	◊ Do not restrict subject headings to major focus
◊ Choose any relevant subheadings	◊ Do not choose subheadings
◊ Utilize limits to English language, human subjects, review articles, etc.	◊ Consider searching back in time, look at citations
	◊ Consider doing a keyword search

♦ Boolean Operators:

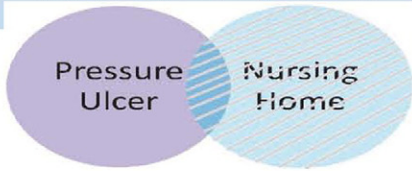
AND (Pressure Ulcer AND Nursing Home)	OR (Pressure Ulcer OR Bedsores)	Not (Pressure Ulcer NOT Nursing Home)
		
Retrieves records that contain *BOTH* terms entered	*Retrieves records that contain either ENTERED term*	Retrieves records that exclude the term following the operator

Fig 2. continued.

Table 1. Tips for Working With a Librarian

- ✔ Be clear about what you want to find out. Come to your meeting with the nursing or medical librarian with a clear research question written out. This will help provide some direction to the search.
- ✔ Give the purpose of the search. Is the search needed for current or incoming patient? Is it ongoing research or a class assignment? The purpose will help to determine the types and scope of articles and sources the librarian will show you.
- ✔ If the purpose of the search is an assignment, be sure to know the requirements of the assignment or bring a copy of the requirements with you to your meeting with the librarian. Listed below are a few of the questions to consider to better delineate your search:
  - ○ Period (How many years do you want to search?)
  - ○ Age range of patients of interest
  - ○ Types of literature (*if known*) you believe will contribute to your topic of interest
- ✔ Create a list of related terms or key words for the main terms of your search. The items indexed or described in a citation database can vary. Begin a list and add to the list everything you believe that may have relevance; too many terms is actually better than not enough terms. Terms can be narrowed after a discussion with the librarian.
- ✔ If the disease or condition is complex, try to explain it in simple language. Remember that the librarian is familiar with health care but not a health care professional, so explaining the phenomenon in simple terms can really facilitate the searching process and your communication with the librarian.
- ✔ If you have done some searching on your own and found any articles that you feel are related to your topic, bring them to your meeting with the librarian. These articles can be used to help find more related search terms and articles.
- ✔ Be prepared to spend some time, and be open to adjusting your search and a second session with the librarian. A search is a process, and to obtain good results, it will take some time. It may also mean an adjustment in your search as well. Most systematic searches are not completed in the first sitting and may take multiple searches to get the scope of the project narrowed to support the intended work.

Problem/Construct the Question

We suggest to, as a starting point, do a quick search using key words or phrases in PubMed, CINAHL, or even Google Scholar. This search will help one to gain a greater understanding of the topic and to see what already exists in the literature. If you have access to point of care tools like First Consult, Up to Date, or PubMed Health, these could also be useful in gaining greater understanding. A quick search like this will also serve as a means to begin finding additional key words and, more importantly, the subject headings that will be relevant to your search. Writing out the question so that it delineates exactly what your search is related is very important because it provided a defined focus for the search. The population, age, sex, or race, if appropriate, as well as the disease or condition of interest can all be important in refining the question (see the first page in the Search Process Checklist). For evidence-based practice, the question is often written as PICO (Population, Item of Interest, Comparison, Outcome).[6-10] However, what is most important is writing your thoughts about what it is that is important to your question or the outcome of your search and what is not important. The thinking time put into focusing the search before beginning will support a more efficient search of the databases.

Choose the Appropriate Database(s) or Resources for the Topic

The topic or purpose of your search will provide direction as to which databases to use for your search. Many times, PubMed and CINAHL are a good place to start, but if your search is related to a behavioral change, then you might want to also include PsychInfo. The Cochrane Database can also be helpful, but for neonatal topics, the number of systematic reviews can be limited, although the number is growing daily. If your search is related to a change in unit policy or practices, you might want to search the National Guideline Clearinghouse (www.guidelines.gov). This resource provides peer-reviewed guidelines for clinical practices. It is a good place to begin your search if your outcome is to develop or revise a unit policy or practice guideline. All the guidelines found on the site meet a high standard for quality and are peer reviewed and evidence based (see Table 2.).

Why Not Rely on Google or Other Resources on the Internet?

Although Google, Google Scholar, and other Web sites or resources on the Internet might seem easier and at your fingertips, they are not the best sources for finding comprehensive evidence to guide clinical practice. Sources on the Internet may not be appropriately referenced or scientific; in addition, the author may not be the most reputable.[1,2] Anyone can add to Wikipedia or create a Web site. Hence, although they are accessible 24 hours a day/7 days a week and somewhat easier to use, they should only be used after careful evaluation and only be one of the sources that are used for a good comprehensive search of the health care literature.[11,12] It is also important to remember that unless the site is regularly updated (daily is best), the information on a Web site can easily become outdated. In addition, because of the way the World Wide Web is financed, the results that come up first in a search can be related to the advertising and not the most important to your search. If you are going to use materials from the Web, it is important to evaluate them appropriately. Find out who wrote the information. Are they an appropriate expert in the field of interest? Are there disclosures on the Web site? Do they tell you their affiliations or reveal their conflicts of interest? The Web is often a source of merchandize, so it is important to understand the purpose of the materials on a Web

Table 2. Useful Databases for Searching Literature Related to Nursing Topics

Bibliographic Databases	Database Characteristics
CINAHL, available in medical library via EBSCO	Database containing literature pertaining to nursing and other allied health professions
PubMed/MEDLINE www.pubmed.gov	Comprehensive database of biomedical literature
APA PsycNet/PsycINFO, available in medical library via OVID	APA database of psychological literature
Cochrane Library www.thecochranelibrary.org	Systematic reviews of randomized control trials. These systematic reviews are often considered the highest level of evidence.
National Guideline Clearinghouse www.guideline.gov	Evidence-based clinical practice guidelines
Evidence-based Nursing http://ebn.bmj.com	Research that is relevant to nursing is reviewed with a commentary on the key findings and implications for clinical practice.
Joanna Briggs Institute http://www.joannabriggs.edu.au/	The institute is known for providing reliable evidence that health professionals can use to inform their clinical decision making. The institute develops evidence in various formats for nursing, allied health, and medical professionals as well as support information for consumers. Systematic reviews Best practice information sheets
Patient-Oriented Evidence that Matters (POEMS) http://www.essentialevidenceplus.com/content/poems	POEMS are synopses of new evidence carefully reviewed for relevance to patient care. There is a limited number, but those that do exist are very good.
EMBASE, available in medical library via OVID	European version of Medline/PubMed. Contains similar medical information but mostly from European journals
Dissertations and Theses Full Text (Proquest)	Interdisciplinary database that will allow you to search for dissertations and abstracts that may not have been published and are not accessible in other databases.

APA, American Psychological Association; EBSCO, Software platform used in many medical libraries to support reference databases such as Pubmed and CINAHL); EMBASE, Software platform developed by Elsevier used in many medical libraries to support reference databases such as Medline, and the National Library of Medicine; OVID, Software platform developed by Wolters Kluwer used in many medical libraries to support reference databases such as Pubmed and CINAHL.

site that you use for your search. Do they tell you how current the research they report is? Knowing the answers to these questions will be helpful in understanding how much you will want to rely on these materials as being unbiased and useful in your search or not.[1,2]

Formulate a Search Strategy

Once a question is formulated with a list of potential key words and subject headings, next a search strategy needs to be formulated. The terms one uses in searching the databases are key. As you begin, be sure to write down all potential key words and subject headings. Page 4 of the Search Process Checklist provides tips about choosing key words and considering subject headings. You will want to take some time to consider not only the terms and key words but how you will join them together and how linking the terms changes the outcomes of the search. It is also helpful to keep in mind any potential synonyms or related concepts that may apply because different databases may use different terminology to describe the same phenomenon. Having these alternatives will help in effectively getting to the relevant articles. As you get results, you will be able to refine the list to those that truly answer the question of interest. Also, keeping notes about the search strategy will be important if the search needs to be repeated. In addition, the search strategy will be needed to use to validate the systematic nature of the search that you will want to document in the methods section of a systematic or integrative review manuscript. The search strategy includes the steps taken in the search process. Which databases are used, which terms were combined, and which terms will be searched separately or are more applicable in one database but not in another are things that should be noted.[7,8,11,12] Remember that your search is seldom completed in one sitting so you will want to remember what you did from one search to the next. In addition, if you have good notes about the search strategy, it will make it easier to set up another search in another database. Always make it a practice to search more than one database to insure that you are doing as comprehensive a search of the literature as possible. Each database contains different journals and will yield some different results. Also, keep in mind that once you create a good search strategy, in most databases, you can save the search and set up the search strategies to run periodically (automatically) as alerts so that you can get updates as new literature about your question of interest comes out without actually going back into the database and repeating the search.[3,4] Another reason you will want to have the notes from your well-designed search strategies is so you can run them

Table 3. Tips to Increase the Usefulness of Your Results	
Ways to Expand Your Results	Ways to Focus Your Results
● Explode your terms	● Consider narrowing the terms to major concept or subject
● Consider adding key words to the search with subject headings	● Use subheadings
	● Use the limits such as sex or age

again in a different database. Remember that if you run your search in more than one database, you may need to refine the search terms and/or key words to take advantage of how the particular database has been designed.

Perform the Search

Now, you are ready to perform the search. Be patient, and use your terms together and separately. It is best to start by searching your terms separately and then combine them. By first searching each separately, it will be easier to manipulate the terms of your search as you proceed. The order that you put terms together can affect your results, so you will want to pay attention to the results of your search as you go along. You often find that you need to revise the terms based on your results. Keep notes about all the changes that you make as you continue to refine the search. If your search provides too many results (>100), you probably need to refine the search. This is also true if your results are too few. As you continue to work in the database, the refining of the results will be guided by the evidence that you find (see Table 3).

Evaluate the Results

There are several ways to evaluate the results of your search. Most begin by reading all the abstracts as a means to further tell if the article is truly going to meet the aims of your search. In addition, most articles now list key words, so reading those can help you continue to refine your search strategy and list of terms for your search. Another place to look is the reference list. Are there articles on the reference lists of articles that answer your question that are not coming up in your search? You need to consider why this is happening. They may be from an obscure journal not indexed in the databases you are using or the key words you have used are not getting at the whole question, and again, refining of the search is needed. Once the search is near completion, you will want to read each article from end to end to further decide if it fits the question you set out to answer.

Good Results (Answer the Question) = Use the Data, Bad Results = Start Over (Refine the Search Strategies)

Refining is a continual process that occurs throughout the search and hopefully gets the searcher to a place where starting over is not the correct option, but refinement is definitely a possibility. Do not get frustrated, and do not feel like you have been searching for hours and wasting your time. Often, that is just not the case you have been refining the terms and clarifying the search. Remember that using a librarian to support your searching is an excellent option because they have the knowledge about the nuances of the databases that can be combined with your knowledge of the clinical issue to yield results that address your topic.

Conclusions

Searching the literature does take time, but with a little forethought and planning, systematic searching does get easier and will provide the basis for implementing comprehensive evidence-based practice into routine care. Neonatal nurses who collaborate with medical or nursing librarians can execute a systematic search that will yield good results and change practice.

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