

Literature Searching for Practice Research

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In 2007, the American Association of Nurse Anesthetists endorsed the doctor of nurse anesthesia practice (DNAP) for entry into the profession by the year 2025. More and more Certified Registered Nurse Anesthetists (CRNAs) and graduate students are completing or will be required to complete a doctor of nursing practice (DNP) or DNAP project as the final scholarly work culminating in their advanced degrees. Although DNP/DNAP projects may take various forms depending on the academic institution, in most instances, the need to conduct a literature review is a key step in the process. Partnering with academic or hospital librarians

in searching the literature is beneficial because of their expertise in information science and time-saving abilities. For CRNA professionals and students who may not be able to work directly with a librarian, this article aims to provide useful strategies for thoroughly searching relevant literature in support of a high-quality DNP/DNAP project and research that a practicing CRNA may conduct.

Keywords: Capstone project, doctor of nurse anesthesia practice/doctor of nursing practice literature review, database search, nurse anesthesia doctoral education.

Competency in literature searching supports evidence-based practice to integrate the best available research with clinical experience and patient values. To make informed patient care decisions and to further professional scholarship and research, a clinician needs the ability to locate relevant and high-quality information throughout his or her career. As more practicing Certified Registered Nurse Anesthetists (CRNAs) return to school to earn doctoral degrees and as entry-into-practice students pursue a doctorate, literature searching assumes another important role in the completion of scholarly work as required by the Council on Accreditation of Nurse Anesthesia Educational Programs.¹

When identifying a topic of interest to pursue for a professional doctoral project or for evidence-based practice, a student or CRNA must search for and browse relevant literature to gain a general understanding of a broad topic and discover gaps where further research is needed. Insight into tested research approaches is needed, and, indisputably, comprehensive searching is necessary before one conducts an impartial critical literature review.

Although information is readily discoverable online, examination of the full set of evidence requires conducting a methodical search. An incomplete search, resulting in a partial selection of articles, could possibly mislead the one conducting the search to form biased conclusions in the literature review. To operate within an objective scientific framework, one must employ a strategic and systematic approach to formulating a search strategy; doing so will also make the most efficient use of time over the long term. Meeting with academic or hospital librarians for guidance is highly recommended to tap into their

information science background, advanced searching skills, and familiarity with specialty information sources. Touching base with a reference librarian may also assist with brainstorming related keywords, selecting appropriate databases to search, and obtaining full text articles and other resources that may not be readily accessible.

Searching for information is an iterative process involving mental flexibility to pursue alternative approaches as understanding increases.² Results from an initial search attempt will likely be insufficient, and, therefore, reevaluation and modification of the search will be needed. Successful searching relies on creative thinking and setting aside sufficient time for exploration. If collaboration with a health sciences librarian is not possible or there is a preference to work more independently, the librarian-recommended steps outlined in the following sections serve as an empowering guide for effectively searching the anesthesia literature. Refer to Table 1 for a concise list of essential and recommended optional steps for conducting a thorough search.

Format a Clinical Question or Statement

When you begin exploring a clinical research issue of interest, it is recommended to first frame the question or problem statement so it is not overly broad. For a quantitative research approach addressing outcomes, format the clinical question or problem statement using the PICO(T) mnemonic. In this mnemonic, P represents the patient group or problem, I stands for the intervention to be tested, C serves as a comparison intervention (which may be the current practice or gold standard), O introduces the resulting outcome (or outcomes) of the intervention (or interventions), and T, marked in parentheses, covers the specific timeframe or type of

Essential steps

- Use the PICO(T)/PICO mnemonic to format a clinical question or statement
- Underline the key concepts in the written clinical question or statement
- Identify related keywords/synonyms for the key concepts
- Search for subject headings, one at a time, in multiple relevant scholarly databases
- Restrict relevant keywords to particular fields such as [title/abstract]
- Consider using shortened root words followed by an asterisk [eg, *anesthe**] to include various endings
- Combine similar keywords and subject headings using OR surrounded by parentheses
- Connect distinct elements with *AND*
- Apply relevant limits (eg, English language, date range); avoid checking humans tag and full text

Recommended optional steps

- Create an account in databases to save searches
- Export results to a reference manager program (eg, EndNote, ProCite, RefWorks, Zotero, Mendeley^a)
- Check the references included in the bibliographies of important primary studies
- Consider looking for references that have since cited important primary studies
- Check key secondary sources (textbooks, practice guidelines, <http://www.aana.com>, etc)

Table 1. Essential and Recommended Optional Steps for Conducting a Thorough Search

^aEndNote, Clarivate Analytics; ProCite, Thomson Corp; RefWorks, ProQuest LLC; Zotero, Roy Rosenzweig Center for History and New Media; and Mendeley, Mendeley Ltd/Elsevier.

question (eg, diagnosis, therapy, harm) if befitting.³ Alternatively, for a qualitative research approach addressing human behaviors, format a question or statement using the PICO mnemonic with a lowercase o, where P similarly represents the population or patient group, but I stands for the interest phenomenon, and Co symbolizes the context.⁴

It is helpful to write or type the PICO(T) or PICO question or statement so you can clearly analyze it before conducting an online database search. A hypothetical example of a PICO(T) question for the purposes of this article might be stated as “In surgical patients, does listening to music in the perioperative setting have an impact on anxiety and postoperative pain?” Refer to Table 2 to view how the question is structured under the PICO(T) format. This example of a PICO(T) scenario does not specify a comparison in the written question; however, it can be assumed that the intervention would be measured against the current practice of no music playing. The timeframe is the perioperative period. It is also a therapy-type question by examining the potential reduction in patients’ anxiety and pain and, by extension, sedative requirements using a music intervention.

Formatting your clinical question/problem with PICO(T)

P = patient population or problem

I = intervention

C = comparison intervention or gold standard (if applicable)

O = outcome(s) to be measured

(T) = timeframe and/or type of question (if applicable)

Example of PICO(T) question

“In surgical patients, does listening to music in the perioperative setting have an impact on anxiety and postoperative pain?”

P = surgical patients

I = music

C = current practice (no music)

O = anxiety and pain

(T) = between admission and discharge, therapy

Table 2. PICO(T) Format for Clinical Problems/Questions With Example

Identify Key Concepts and Synonyms

Once a PICO(T) or PICO question or statement is thoughtfully developed, the next step is to analyze the written or typed sentence and underline or highlight the chief concepts that will become the foundation of the search. These primary words serve as building blocks for the search strategy.⁵ Take a few moments to create a list or table with additional synonyms and alternate spellings when applicable, which could be considered as related search words for each of the key concepts. See Table 3 for an example. The words listed are referred to as keywords or text words. By performing the brief exercise of listing multiple synonyms and spellings, you will increase the probability of obtaining a greater set of relevant results because there is not a complete reliance on matching the authors’ verbiage. Anticipate that the search strategy will continue to grow and evolve as other relevant terms are identified during the literature scanning process.

Consider Scholarly Databases to Search

Next, consider which scholarly databases to search; databases differ by the journals, date spans, and types of publications indexed. Table 4 provides a summary of the various scholarly databases discussed in this article. Scholarly databases offer powerful searching mechanisms, and the journal sources indexed have been vetted to cover mostly peer-reviewed titles. Best practice requires checking multiple databases when you are attempting to undertake a thorough scope of the literature for greater credibility. Nurse anesthesia topics span across advanced nursing practice and biomedicine; therefore, 3 important databases merit searching for anesthesia literature: CINAHL, Embase, and PubMed.

EBSCO’s Cumulative Index to Nursing and Allied

Surgical patients/ perioperative	Music	Anxiety	Pain
operating room	music therapy	stress	analgesia
PACU		distress	sedatives
recovery room		anxiolytic	anesthesia
surgery			narcotics
preoperative			opioids
intraoperative			
postoperative			
perioperative			
pre-anesthesia			
post-anesthesia			

Table 3. Synonyms for Key Concepts in Example of PICO(T) Question

Abbreviation: PACU, postoperative anesthesia unit.

Database	Scope	Utility	Subject headings offered	Availability
Academic Search Premier	Multidisciplinary	Optional	Yes	Check library
Business Source Premier	Business/management	Optional	Yes	Check library
CINAHL	Nursing and allied health	Vital	Yes	Check library
Embase	Biomedicine	Vital	Yes	Check library
ERIC	Education	Optional	Yes	Free
Google Scholar	Multidisciplinary +cited reference searching	Optional	No	Free
PubMed	Biomedicine	Vital	Yes	Free
PsycINFO	Behavioral sciences	Optional	Yes	Check library
Web of Science	Multidisciplinary + cited reference searching	Optional	No	Check library

Table 4. Scholarly Databases to Consider Searching

Abbreviation: CINAHL, Cumulative Index to Nursing and Allied Health Literature; ERIC, Education Resources Information Center; +, plus.

Health Literature, better known as CINAHL, should be considered for a nursing perspective, especially on issues pertaining to nursing education, practice, and theory. Access CINAHL through a health sciences library's electronic resources because it is subscription based. The National Library of Medicine's foremost database, PubMed, is an essential resource for its broad coverage of biomedical literature. PubMed contains Medline-indexed citations as well as citations from general chemistry and science journals outside the scope of Medline and some electronic books and documents. Although PubMed is freely available online (<http://pubmed.gov>), accessing it through an academic or hospital library's website is advised to take advantage of licensed e-journal content and appended online request forms. A third highly recommended database is Elsevier's Embase database, often thought of as PubMed's European counterpart, which may be available through a library's subscription databases. Embase is reputed for its deep indexing of drug and medical device topics as well as its coverage of unique

international journals and conference abstracts.

Obtaining diverse disciplinary perspectives may be necessary if a topic crosses outside the realm of health-care. For clinical research topics pertaining to adult or higher education, consider searching education-themed databases such as EBSCO's Academic Search Premier database and the US Department of Education's Education Resources Information Center, better known as the ERIC database (freely available at <http://eric.ed.gov>). Other databases to keep in mind, depending on the nature of a topic and a library's licensed resources, include PsycINFO for detailed coverage of behavioral sciences, as well as EBSCO's Business Source Premier and/or other business-oriented databases if the topic pertains to administrative and management issues. Google Scholar (<http://scholar.google.com>), although not a traditional indexing and abstracting database, is freely available and is recognized for its searching capabilities within the full text of a wide selection of multidisciplinary online sources.

Before you conduct searches in earnest, it is advised to

Help topic	Link to site
PubMed Quick Start guide	http://www.ncbi.nlm.nih.gov/books/NBK3827/#pubmedhelp.PubMed_Quick_Start
PubMed tutorials	https://www.nlm.nih.gov/bsd/disted/pubmed.html
CINAHL help sheet	http://support.epnet.com/knowledge_base/detail.php?id=2814
Using CINAHL/ MeSH headings	http://support.epnet.com/training/flash_videos/cinahl_mesh/cinahl_mesh.html
Embase advanced search overview (through Ovid)	http://site.ovid.com/help/tutorials_ovidsp_3/advSearch20100429/advSearch20100429.htm

Table 5. Help Links

Abbreviations: CINAHL, Cumulative Index to Nursing and Allied Health Literature; MeSH, Medical Subject Headings.

<p>Embase tutorials under Database/Resource-Specific Courses at http://www.ovid.com/site/support/training.jsp: Using CINAHL/MeSH headings: https://help.ebsco.com/interfaces/CINAHL_MEDLINE_Databases/Training_Promotion/CINAHL_MeSH_Headings_Tutorial Introduction to EMBASE https://www.brainshark.com/wkovid/vu?pi=zEjz180dYz34XJz0&cmpid=Brainshark:EmbaseIntro&nodesktopflash=1 Advanced techniques in EMBASE https://www.brainshark.com/wkovid/vu?pi=zHvz2LYvMz2tkwz0&cmpid=Brainshark:EmbaseAdvanced&nodesktopflash=1</p>
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Table 6. Help Links

Abbreviations: CINAHL, Cumulative Index to Nursing and Allied Health Literature; MeSH, Medical Subject Headings.

review online database tutorials and help materials. Your library may have such resources posted on its website, or these materials can often be found as part of the help features inside the database. See Tables 5 and 6 for links to examples of help materials for PubMed, CINAHL, and Embase. Also, consider setting up personal accounts in scholarly databases at the outset. This step is advised so that the search strategies may be saved and subsequently rerun with the option for ongoing alerts. The ability to log in is convenient because interruptions are likely to occur that might prevent completing a search and selecting results in one sitting.

Use Database Subject Headings

After identification of multiple keywords for the main concepts in the clinical question or problem statement as well as the databases to explore, the next step is to become familiar with the databases' relevant subject headings, also referred to as controlled vocabulary or thesaurus terms. The acronym, MeSH, which stands for Medical Subject Headings in PubMed, may be somewhat familiar from past education. If searching CINAHL or Embase, use the comparable CINAHL headings or Emtree headings. Incorporating these special terms as part of a methodical approach will capitalize on the databases' indexing or tagging system and strengthen search results. After all, "the key to effective searches is a foundation of well-and carefully-selected terminology."⁶

Most citations included in traditional scholarly databases are tagged by expert indexers with appropriate subject headings *about* the topics covered in the articles. Although successful searching with keywords relies

on locating exact matches with an author's choice of wording, subject headings deal with seeking the broader contextual themes of the articles. For example, searching with the keyword *fall* might yield results pertaining to the autumnal season or an altogether different sense of the word such as in the phrase *fall asleep*. The MeSH term *Accidental Falls* is tagged to articles addressing injurious falls due to slipping or tripping.

Subject headings also cover British spellings as well as more specific forms of a concept. For instance, searching with the MeSH term *Hemorrhage* will generate results pertaining to excessive bleeding (not just a casual mention of the word *hemorrhage*) that may also use the alternative spelling *haemorrhage*. Additionally, results will incorporate particular types of hemorrhage such as bleeding during or after surgery or an excessive loss of blood giving rise to hypovolemic shock based on the narrower MeSH terms *Blood Loss*, *Surgical*, *Postoperative Hemorrhage*, and *Shock, Hemorrhagic*. These narrower headings appear indented under the MeSH term *Hemorrhage* in a hierarchical arrangement known as a tree structure. Figure 1 shows the MeSH term *Hemorrhage* in PubMed with part of the hierarchical tree structure. The inclusion of narrower concepts occurs automatically in a PubMed search but may need to be explicitly selected in CINAHL and Embase.

Some traditional scholarly databases offer a feature to search for results in which the subject heading has been tagged as a central key concept. This unique and effective tool, referred to as Major Topic in PubMed (indicated in Figure 1), is especially helpful when an overwhelming amount of literature exists on a topic. Use your best judg-

Hemorrhage

Bleeding or escape of blood from a vessel.

PubMed search builder options

Subheadings:

- | | | |
|--|--|--|
| <input type="checkbox"/> analysis | <input type="checkbox"/> epidemiology | <input type="checkbox"/> physiology |
| <input type="checkbox"/> anatomy and histology | <input type="checkbox"/> ethnology | <input type="checkbox"/> physiopathology |
| <input type="checkbox"/> blood | <input type="checkbox"/> etiology | <input type="checkbox"/> prevention and control |
| <input type="checkbox"/> blood supply | <input type="checkbox"/> genetics | <input type="checkbox"/> psychology |
| <input type="checkbox"/> cerebrospinal fluid | <input type="checkbox"/> history | <input type="checkbox"/> radiography |
| <input type="checkbox"/> chemically induced | <input type="checkbox"/> immunology | <input type="checkbox"/> radionuclide imaging |
| <input type="checkbox"/> chemistry | <input type="checkbox"/> injuries | <input type="checkbox"/> radiotherapy |
| <input type="checkbox"/> classification | <input type="checkbox"/> isolation and purification | <input type="checkbox"/> rehabilitation |
| <input type="checkbox"/> complications | <input type="checkbox"/> legislation and jurisprudence | <input type="checkbox"/> secondary |
| <input type="checkbox"/> congenital | <input type="checkbox"/> metabolism | <input type="checkbox"/> statistics and numerical data |
| <input type="checkbox"/> cytology | <input type="checkbox"/> microbiology | <input type="checkbox"/> surgery |
| <input type="checkbox"/> diagnosis | <input type="checkbox"/> mortality | <input type="checkbox"/> therapy |
| <input type="checkbox"/> diet therapy | <input type="checkbox"/> nursing | <input type="checkbox"/> transmission |
| <input type="checkbox"/> drug effects | <input type="checkbox"/> organization and administration | <input type="checkbox"/> ultrasonography |
| <input type="checkbox"/> drug therapy | <input type="checkbox"/> parasitology | <input type="checkbox"/> urine |
| <input type="checkbox"/> economics | <input type="checkbox"/> pathology | <input type="checkbox"/> veterinary |
| <input type="checkbox"/> embryology | <input type="checkbox"/> pharmacology | <input type="checkbox"/> virology |
| <input type="checkbox"/> enzymology | | |

Restrict to MeSH Major Topic.

Do not include MeSH terms found below this term in the MeSH hierarchy.

Tree Number(s): C23.550.414

MeSH Unique ID: D006470

Entry Terms:

- Hemorrhages
- Bleeding

See Also:

- [Bloodletting](#)
- [Phlebotomy](#)

[All MeSH Categories](#)

[Diseases Category](#)

[Pathological Conditions, Signs and Symptoms](#)

[Pathologic Processes](#)

Hemorrhage

[Blood Loss, Surgical](#)

[Ecchymosis](#)

[Epistaxis](#)

[Exsanguination](#)

[Eye Hemorrhage](#)

[Choroid Hemorrhage](#)

Figure 1. PubMed Hierarchical Tree Structure of MeSH Term *Hemorrhage* With Narrower Indented Terms Automatically Included^a

^aMeSH (Medical Subject Headings) Major Topic option and subheading options are indicated by boxes.

(Source: US National Library of Medicine PubMed, <http://www.pubmed.gov>.)

ment when deciding whether to check the Major Topic box because this action may have the effect of overly restricting the results. General advice is to postpone ap-

plying the Major Topic feature until you determine the quality and number of broad search results, especially when combining with the other elements of the clini-

PubMed.gov
US National Library of Medicine
National Institutes of Health

PubMed [dropdown] [search box]
Advanced

Abstract [dropdown] Send to: [dropdown]

Br J Anaesth. 2013 Oct;111(4):549-63. doi: 10.1093/bja/aet154. Epub 2013 May 9.

Antifibrinolytic agents in current anaesthetic practice.

Ortmann E¹, Besser MW, Klein AA.

Author information

Abstract

KEYWORDS: antifibrinolytic agents; cardiac surgical procedures; hepatectomy; intracranial haemorrhages; liver transplantation; orthopaedics; post partum haemorrhage; postoperative haemorrhage; wounds and injuries

PMID: 23661406 [PubMed - indexed for MEDLINE] [Free full text](#)

Publication Types, MeSH Terms, Substances

Publication Types
Review

MeSH Terms

- [Aminocaproic Acid/adverse effects](#)
- [Aminocaproic Acid/therapeutic use](#)
- [Antifibrinolytic Agents/adverse effects](#)
- [Antifibrinolytic Agents/therapeutic use*](#)
- [Aprotinin/adverse effects](#)
- [Aprotinin/therapeutic use](#)
- [Blood Loss, Surgical/prevention & control](#)
- [Cardiac Surgical Procedures/adverse effects](#)
- [Female](#)
- [Hemorrhage/drug therapy](#)
- [Humans](#)
- [Liver/surgery](#)
- [Neurosurgical Procedures/adverse effects](#)
- [Orthopedic Procedures/adverse effects](#)
- [Postoperative Hemorrhage/prevention & control*](#)
- [Postpartum Hemorrhage/drug therapy](#)
- [Pregnancy](#)
- [Tranexamic Acid/adverse effects](#)
- [Tranexamic Acid/therapeutic use](#)
- [Wounds and Injuries/complications](#)

Figure 2. Full Record of PubMed Article Citation Displaying Tagged MeSH Terms^a

^aViewing MeSH (Medical Subject Headings) terms may introduce new and unfamiliar terms to incorporate into the search strategy. (Source: US National Library of Medicine PubMed, <http://www.pubmed.gov>.)

cal question or statement. Keep in mind that the search strategy may always be readjusted if there are too few or too many results.

Another feature associated with subject headings is an assortment of subheading options representing aspects of a concept such as complications, epidemiology, and genetics. Figure 1 displays the array of subheadings for the MeSH term *Hemorrhage*. Librarians generally recom-

mend including all subheadings for a complex search to avoid unintentionally excluding results. The databases are defaulted to automatically include all subheadings so this grouping of checkboxes may be readily bypassed. Selecting 1 or 2 subheadings is suggested only for simpler searches, such as when you want to single out the adverse effects of a drug or procedure.

Besides identifying appropriate subject headings



Figure 3. PubMed’s Advanced Search Builder Including Drop-Down Menus With Field Codes for Keyword Searching (Source: US National Library of Medicine PubMed, <http://www.pubmed.gov>.)

through a direct search of the database thesaurus, additional terms may be discovered by viewing the complete records of especially relevant citations. More details about the citation are displayed in this area, such as the abstract and type of publication (eg, clinical trial, editorial) as well as the tagged subject headings. Figure 2 depicts the full record of a sample article citation with the associated MeSH terms. Complete records may be opened with just an extra click when scanning through the list of search results. Viewing complete records to gather extra keywords and subject headings, a process known as “pearl growing” by librarians, may be another useful method to help craft the search strategy for improved results.^{5(p314)}

When you search for subject headings, it is important to search individually for one underlined concept of the formatted question or problem statement at a time. The concepts will be recombined later. If you enter the entire sentence of a PICO(T)/PICO question or statement into the search box or, even just the main key concepts all at once, few results may be generated. Also, a practical tip when searching for a 4- or 5-part PICO(T) formatted question or statement is to initially build just the 2 or 3 most important components into the search strategy. If the results are unmanageable, then add the extra 1 or 2 remaining concepts. It is entirely possible that a corresponding subject heading may not exist in a database’s thesaurus. In this situation, search initially with only the keywords that represent the concept. Potentially, related subject headings may be found through the pearl growing method of examining the complete records of very relevant results.

Search Keywords Using Truncation and Terms

To develop a thorough search strategy, you should use a combination of both keywords and subject headings because neither method by itself is absolute. Although subject headings are advantageous, they do possess slight inherent weaknesses. Because of differences in subjective interpretation by human indexers, subject headings are not always consistently applied to articles, and there is usually a delay from the time a citation has been entered into the database to the point when it is fully processed and tagged.

If you search only with subject headings, you may miss the most recently added citations to the database; therefore, include keywords in the search strategy as well.

Because simple keywords tend to retrieve results out of context, follow the ensuing recommendations for enhancing search outcomes. In addition to incorporating multiple synonyms, consider shortening keywords to their root words followed by an asterisk. The asterisk performs a database function known as truncation, which enables searching for various word endings. For example, *anesthe** pulls in anesthesia, anesthetic, anesthetist, anesthesiologist, and anesthesiology. Most scholarly databases also provide a way to search particular fields within citation records such as the title field. Searching for keywords confined to important fields such as title or abstract may yield more relevant results. PubMed provides a combined title/abstract field code in brackets, abbreviated as [TIAB], which may be inserted directly after a keyword (eg, *anesthe*[TIAB]*). PubMed’s advanced search area also contains a search builder tool in which field codes such as title/abstract may be selected from a drop-down menu. Figure 3 contains an image of PubMed’s Advanced Search Builder tool.

Use Boolean Logic

For the database to successfully interpret the combination of keywords and subject headings pertaining to the PICO(T)/PICO question or statement, you will need to formulate a complex search strategy using Boolean logic, which basically functions somewhat like algebraic equations using the connectors AND and OR offset with balanced parentheses. “Boolean algebra works in database searches like parentheses do in arithmetic.”^{6(p19)} The connector OR is inserted between synonyms or similar terms grouped in a set surrounded with opening and closing parentheses. It is best to keep the OR capitalized because some databases will not recognize the function if it is lowercase. In PubMed, the section of the sample PICO(T) search strategy pertaining to pain might be arranged as follows: (“Pain”[Majr] OR “Anesthesia and Analgesia”[Majr] OR “Anesthetics”[Majr] OR “Analgesics”[Majr] OR pain[TIAB] OR analges*[TIAB] OR

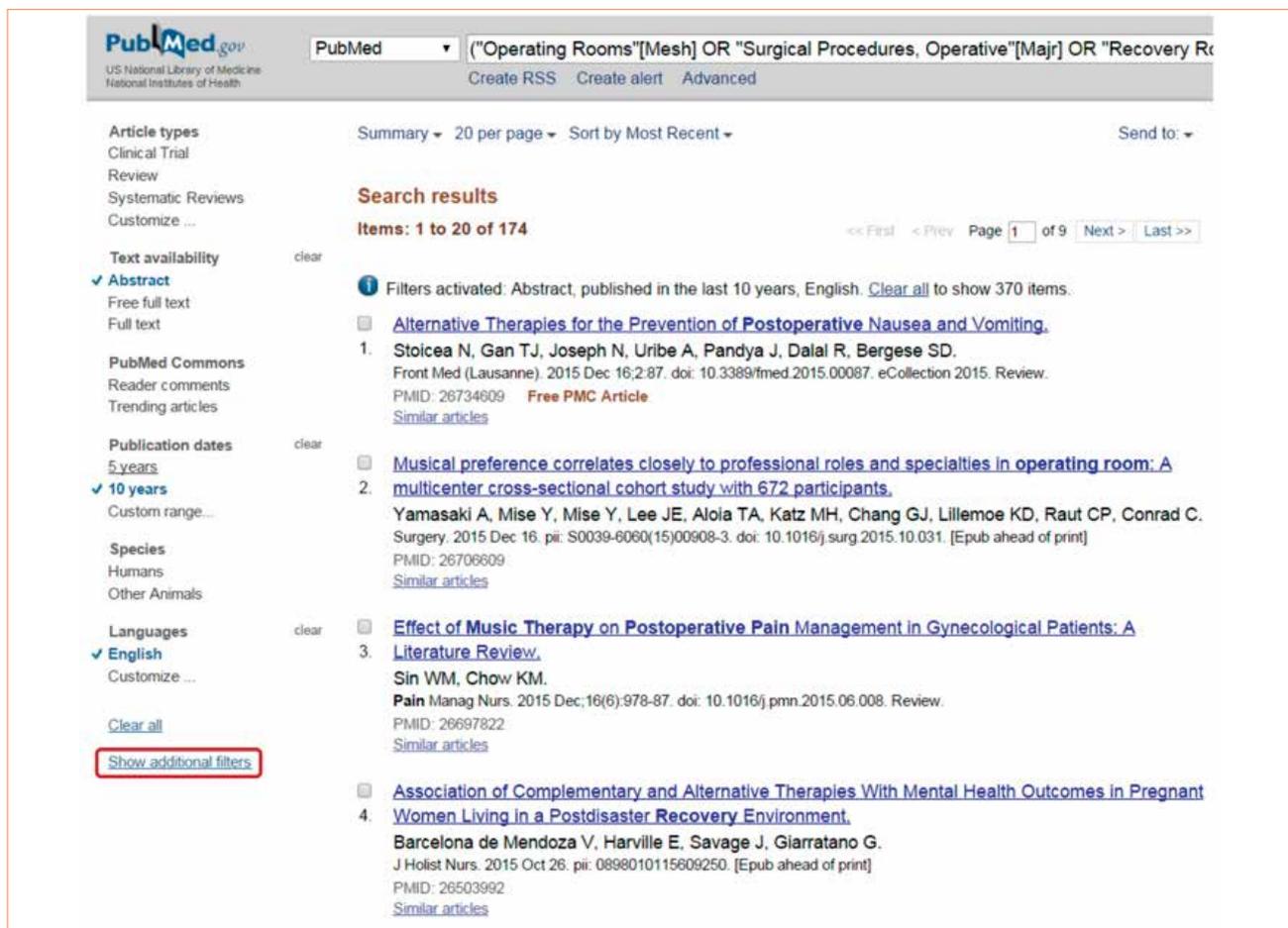


Figure 4. Limit/Filter Options in PubMed, Located on Left Side of Search Results
(Source: US National Library of Medicine PubMed, <http://www.pubmed.gov>.)

sedative[TIAB] OR aneshe*[TIAB] OR anaeshe*[TIAB] OR narcotic*[TIAB] OR opioid*[TIAB]*). Parentheses enclose the MeSH terms, which are distinguished by quotation marks and brackets and are assigned to the *Major Topic* setting, as well as comparable truncated keywords limited to the *title/abstract* fields so that any of these terms will be searched as a possible option.

The other main connector, AND, is inserted between *different* concept sets to restrict to the overlapping results containing each unique concept. For connection of the distinct concepts of music and anxiety, for example, the search string might be structured as follows: (*"Music"*[MeSH] OR *"Music Therapy"*[MeSH] OR *music*[TIAB]) AND (*"Anxiety"*[Majr] OR *"Stress, Psychological"*[Majr] OR *anxi*[TIAB] OR stress*[TIAB] OR distress*[TIAB]*). The connector AND effectually merges the sets, thereby narrowing the results to citations containing both themes of music and stress.

In the complete PICO(T) sample search strategy, all the perioperative-related terms should be grouped in a set with ORs, as should the respective music-related terms. The pain and anxiety terms should also be clustered in 1 large set with ORs because either or both outcomes are of

interest. The connector AND is used to unite the 3 essential concepts: (perioperative setting terms) AND (music terms) AND (pain terms OR anxiety terms).

Set Limits

Once the sets of terms have been appropriately combined to represent the most important elements of the clinical question or statement, consider applying a couple of practical limits or filters provided by the database, such as the span of years covered and English language. Figure 4 displays some of PubMed's readily available filter options. Use other limits sparingly, including the humans tag because it may not have been consistently applied across database records. Also, avoid checking the *full text* limit because library journal access is typically broader than what is detected or contained in a database as full text. Incidentally, interlibrary loan is a valuable service that a library may offer to obtain resources at no cost or for a nominal fee from another library when the materials are not part of the library's regular collection.

After practically applying the full PICO(T) sample search strategy in PubMed, consisting of a combination of both MeSH terms and keywords limited to the *title/*



Figure 5. Google Scholar’s “Cited by” Feature, Locates More Recent References Citing an Original Reference
(Source: Google Scholar, <https://scholar.google.com>)

abstract fields and restricted to English language from the current 10 years, the authors found approximately 250 citations compared with only around 100 results using MeSH terms alone, and less than 10 citations when relying on only the exact keywords from the original PICO(T) question. Even with a well-crafted search strategy, there may be irrelevant results that need to be manually filtered by skimming through the titles and abstracts. Searching CINAHL and Embase with a similar customized strategy will yield some duplicate citations but also worthwhile unique results not contained in PubMed.

Manage References

To aid with organizing citations of interest and deduplicating results from multiple databases, export selected references into a personalized collection using a tool known as a citation or reference manager (eg, EndNote, ProCite, RefWorks, Zotero, Mendeley; see Table 1 footnote for manufacturers’ names). Likely, an academic program supports 1 or more citation manager programs. These programs will not only store selected references with the full electronic documents or links as well as annotations but also create formatted bibliographies and in-text citations in the American Medical Association style or other editorial styles for manuscripts by working with word processing software. Because clinicians frequently perform searching in multiple stages or while the practice doctorate project research evolves, it is advised to set up personal accounts in the various databases so searches can be easily saved, modified, and rerun without needing to fully re-create them over again. Importantly, logging in to revisit saved searches enables systematic exporting of citations to a reference manager, which cannot be readily done outside an active database search. The saved search strategy under personal accounts also makes documenting the details of the search less demanding if required by the doctorate program or author submission guidelines.

Build References

A couple of other supplementary methods exist for finding

relevant journal articles. Scanning the bibliographies of preidentified relevant articles is one way to find potentially useful references. This method, also known as the ancestry approach, follows the research backward in time.⁷ Although the resources will be older, they may include landmark studies that might easily be missed if you are searching only more current literature. Another type of reference checking known as cited reference searching follows a particular reference or author forward in time to seek more recent articles that have cited the same work or author.⁸ Web of Science, a subscription-based database, is reputed for its proficiency in this area. However, other databases provide some level of tracking, including Google Scholar, which excels compared with CINAHL, Embase, and PubMed. In Google Scholar, look for the Cited by link located beneath the citations to use the cited reference searching tool, as shown in Figure 5. Keep in mind that very current articles have not had adequate time to be formally cited, so this method works best for articles published beyond the current year or two.

Locate Key Secondary Sources

Aside from journal literature, do not overlook valuable secondary sources such as textbooks; practice guidelines indexed by the National Guideline Clearinghouse (<http://www.guideline.gov/>); professional society websites, which may host online documents including practice standards and position statements; dissertations/theses (indexed by CINAHL and Google Scholar); internal organizational policies; pharmaceutical package inserts; and government documents. If applicable, make it a point to intentionally check an affiliated institution’s intranet, AANA’s official website (<http://www.aana.com>), an academic or hospital library’s online catalog for book resources, Google Books (<http://books.google.com>), and the Food and Drug Administration website (<http://www.fda.gov/>). Although primary sources are preferred because they represent original research, secondary sources may provide useful background and technical information.

Evaluate Resources

While or after you search the literature, it is imperative to critically assess the quality of the gathered evidence. Evidence hierarchies or pyramids place clinical practice guidelines as the uppermost sources of clinical information.⁹ To differentiate credible guidelines, look for the inclusion of an unbiased systematic literature review, a development panel representing multidisciplinary expertise, a grading system to rate the strength of the recommendations and evidence, acknowledgment of funding and any conflicts of interest, external peer review, and scheduled updating frequency.¹⁰ Well-conducted systematic reviews and meta-analyses are other high-level sources of evidence that synthesize comprehensive coverage of relevant primary research, the latter providing statistical estimates of treatment effectiveness. In the evaluation of individual primary studies for treatment interventions, randomized controlled trials surpass observational studies.⁹ Always be aware of potential bias about how individual studies were designed, measured, and interpreted, and look for larger sample sizes to minimize the chance of random errors.

Conclusion

Proficiency with literature searching is integral to carrying out evidence-based practice, which relies on examination of the best research-based information along with clinical experience and the patient's own values. Additionally, searching is a key component of the literature review process for the practice doctorate project. It aids in solidifying a clinical research topic, gleaning information on tested research methods, and proceeding effectively with a systematic critique of the evidence. Partnering with professional health sciences librarians is recommended for anyone undertaking this task to make the most of their expertise and assistance. Those who navigate independently should use available help materials and remember to allow ample time to thoroughly search and gather resources. Beyond the practice doctorate project, developing and practicing effective searching skills has the potential to positively affect evidence-based patient care as well as research and publication opportunities and general lifelong learning needs of all CRNAs.

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