

Strategies for Searching and Managing Evidence-Based Practice Resources

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abstract

Evidence-based nursing practice requires the use of effective search strategies to locate relevant resources to guide practice change. Continuing education and staff development professionals can assist nurses to conduct effective literature searches. This article provides suggestions for strategies to aid in identifying search terms. Strategies also are recommended for refining searches by using controlled vocabulary, truncation, Boolean operators, PICOT (Population/Patient Problem, Intervention, Comparison, Outcome, Time) searching, and search limits. Suggestions for methods of managing resources also are identified. Using these approaches will assist in more effective literature searches and may help evidence-based practice decisions.

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As health care facilities struggle to meet the demands and challenges of a changing practice environment, evidence-based nursing practice has emerged as a consistent factor that helps to ensure high quality, safe, relevant, and up-to-date care while improving patient outcomes (Melnik & Fineout-Overholt, 2011). Using clinical expertise, patient preference, and systematically assessed best evidence available allows nurses to integrate their clinical decision making and problem solving skills to enhance patient care. However, nurses face a variety of barriers that may interfere with the implementation of these evidence-based practices (EBP). One such barrier involves the lack of resources and tools to obtain the necessary evidence. A 2005 study of more than 1,000 U.S. nurses investigated readiness for EBP and found that many nurses were not confident in their

ability to use bibliographic databases to search for relevant research. Seventy-seven percent had never received instruction in the use of electronic resources (Pravikoff, Tanner, & Pierce, 2005). Yet, electronic access to relevant resources and having appropriate search skills are essential to EBP. Even with the exploding growth of the Internet and the recent incorporation of teaching health information technology skills in nursing education, current literature continues to suggest that there are gaps in nurses' abilities to search and collect the most relevant and best evidence from scholarly databases (Green et al., 2014).

Lack of literature search knowledge and access to appropriate databases are obstacles for nurses to implement EBP in their daily practice. Encouraging the successful integration of EBP requires organizational support and awareness from continuing education and staff development educators as well as other staff (Melnik, Fineout-Overholt, Gallagher-Ford, & Kaplan, 2012). Although some health care facilities have medical librarians to assist in the searching and retrieval of research literature, many facilities do not have these resources and support, thereby leaving

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TABLE 1
ELECTRONIC DATABASES

Database	Website	Features
Cumulative Index to Nursing and Allied Health Literature (CINAHL®)	http://www.ebscohost.com/academic/cinahl-plus-with-full-text	Largest searchable nursing and allied health database, with more than 3.9 million records
MEDLINE®	http://www.ncbi.nlm.nih.gov/pubmed	Created by the National Library of Medicine (NLM), this database contains more than 20 million references in life science, biomedicine, and related health topics; content is indexed with the NLM Medical Subject Headings (MeSH)
Cochrane Collaboration and Library	http://www.cochrane.org	Consists of health care databases, with access to more than 4,600 full-text articles; the Cochrane library publishes Cochrane reviews that examine evidence about the effects of health care interventions
Virginia Henderson Global Nursing e-Repository	http://www.nursinglibrary.org/vhl	A free and open-access full-text repository of digital materials related to nursing research; also contains approximately 40,000 abstracts of research studies and presentation abstracts
Social Science Citation Index®	http://www.thomsonreuters.com/social-sciences-citation-index	An interdisciplinary citation index service that includes more than 2,000 journals of various disciplines in the social sciences
PsycINFO®	http://www.apa.org/pubs/databases/psycinfo/index.aspx	Abstracting and indexing database that provides detailed information pertaining to psychological literature from the 1800s to present

nurses responsible for performing appropriate searches on their own. Continuing education and staff development professionals are in key positions to facilitate efficient and appropriate information literacy skill development. Therefore, educators must be knowledgeable about search approaches so that they can serve as a role model, act as a resource for staff nurses, and provide a supportive culture for EBP. The purpose of this article is to provide nurse educators with useful strategies to aid in searching EBP topics using electronic databases and offer recommendations regarding the management of retrieved resources.

IDENTIFYING SEARCH TERMS

Continuing education and staff development professionals must recognize that one of the first steps when conducting effective literature searches involves the identification of the topic and relevant search terms related to the clinical problem of interest. Educators can assist staff in selecting appropriate terms before a formal search of the evidence is started. Search terms are words or phrases that software, databases, and search engines use to produce query results. Typically, after a clinical problem is identified, nurses interested in implement-

ing EBP will use the PICOT format to pose a clinical question. A PICOT question addresses the elements of Population/Patient Problem, Intervention, Comparison, Outcome, and Time (Stillwell, Fineout-Overholt, Melnyk, & Williamson, 2010).

The following example represents an appropriately stated PICOT question:

In adult patients with kidney failure receiving scheduled hemodialysis treatments (P), how does the use of monthly individualized educational sessions regarding dietary adherence (I) compared to group educational sessions (C) affect a patient's fluid gain (O) between scheduled treatments (T)?

As this example illustrates, a well-designed PICOT question will enable nurses to identify the components of a clinical issue. In turn, helping nurses to structure a question in this manner will facilitate a quick and efficient search of the best evidence that can be used to improve practice (Fineout-Overholt, Berryman, Hofstetter, & Sollenberger, 2011). The search terms identified from the provided PICOT example include *adult patients, kidney failure, hemodialysis treatment, individualized educational sessions, group educational sessions,*

dietary adherence, and fluid gain. These terms could be used to search appropriate databases.

CONDUCTING THE SEARCH

Continuing education and staff development professionals can assist nurses in completing relevant searches by guiding them in the selection of the most relevant electronic databases to access. Multiple electronic databases should be searched to ensure the most comprehensive list of evidence is compiled. Commonly used databases for searching clinically related literature are listed in Table 1. These databases include:

- Cumulative Index to Nursing and Allied Health Literature (CINAHL®).
- MEDLINE®.
- Cochrane Collaboration and Library.
- Virginia Henderson Global Nursing e-Repository.
- Social Science Citation Index®.
- PsycINFO®.

The focus and features of each database differ and thus may yield varying search results. These databases can be accessed through an institution's medical library or the Internet. Although access through an institution is often free or paid for through an institutional subscription, many databases charge private users a fee for downloading articles on a personal computer. Health care systems and nurse educators may want to consider developing partnerships with individuals and institutions such as academic institutions that can provide access to relevant databases or assist in searching and reference retrieval.

A variety of approaches may be used to locate the references that most appropriately reflect each component of the clinical problem of interest. Streamlining the search process involves using the identified search terms in a concise manner that will yield the most inclusive results. Developing a systematic and thorough approach to the search will help ensure a complete search is conducted. Educators can assist staff in effectively using search strategies such as controlled vocabulary, truncation, Boolean operators, PICOT search, and search limit techniques to effectively identify relevant resources.

Controlled Vocabulary

One method of locating appropriate references involves the use of controlled vocabulary, also referred to as subject headings. Using this approach, nurses would select a list of words or phrases that are used to index information. MEDLINE uses medical subject headings (MeSH®) as a form of controlled vocabulary to index journal articles. If the particular subject heading that should be used is not known, a keyword search should be completed first. The MeSH Browser (<http://www.nlm.nih.gov/mesh/MBrowser.html>) allows users to enter a term or phrase and locate the appropriate MeSH vocabulary to use for searching. For example, when the term *kidney failure* is entered into the MeSH Browser or MEDLINE, the database matches the term to the controlled vocabulary phrase *renal insufficiency*. All articles that contain the topic of *renal insufficiency* are associated with this one index term.

The image shows a web form titled "Search MEDLINE/PubMed via PICO with Spelling Checker". Below the title is the text "Patient, Intervention, Comparison, Outcome" and the URL "go.usa.gov/xFn". The form has several input fields: "Medical condition:" with the text "kidney failure", "Intervention: (therapy, diagnostic test, etc.):" with "education", "Compare to: (same as above, optional):" with "no education", and "Outcome: (optional):" with "fluid gain". Below these is a "Select Publication type:" dropdown menu currently set to "Not specified". At the bottom are "Submit" and "Clear" buttons.

Figure 1. Example of PICOT (Population/Patient Problem, Intervention, Comparison, Outcome, and Time) search using identified search terms. PICO = PICOT.

When searching databases, if the returned references do not appropriately reflect the search term, using synonyms of the search term should be considered. For example, terms similar to *kidney failure* include *chronic kidney disease* and *end-stage kidney disease*. CINAHL has a search tool that assists with identifying subject headings assigned to keywords. To use this tool, nurses would select the CINAHL Headings tab in the database. Entering the keyword in the search box will prompt the database to search the provided term against CINAHL headings, and a list of related terms will be provided. The provided terms then can be used to narrow or refine the search process. Using the search strategy of controlled vocabulary helps prevent nurses from missing evidence that could help answer the clinical question (Stillwell et al., 2010).

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Truncation

Truncation is another effective search approach that continuing education and staff development professionals can teach nurses to use to enhance their search and retrieval skills. Truncation involves using the root of a search term to locate references that contain variations of the term. To initiate truncation searching, nurses first must identify which truncation symbols

askMEDLINE* (Download iOS App or Android App)
 free-text, natural language (English only) query for MEDLINE/PubMed
 (with GSpell spelling checker)

Enter your question below:
 fluid gain for kidney failure patients receiving individualized educational sessions

Select Publication type: (Optional)
 Not specified Clinical Trial Meta-Analysis Randomized Controlled Trial Systematic Reviews (or Reviews) Practice Guideline

- askMEDLINE + MeSH Speller
- [Search](#) previous queries in askMEDLINE

Figure 2. Example of PICOT (Population/Patient Problem, Intervention, Comparison, Outcome, and Time) search using free text.

the database recognizes. Common symbols include *, !, ?, and #.

In CINAHL, using an asterisk (*) at the end of a word or word stem allows nurses to locate references with all available forms of that term. For example, using the truncated search term *education** retrieves references related to patient education, clinical education, and interactive education. When performing a phrase truncation search, only the final word will be truncated. For example, using the search term *individualized education** identifies references regarding the effects of individualized educational programs and evaluation of individualized educational interventions. Truncation also can be incorporated when searching by controlled vocabulary. Using the strategy of truncation provides nurses with flexibility in the searching process through identifying the plural form of words, accounting for variations in spelling, and finding concepts related to the components of the identified clinical issue.

Boolean Operators

A third type of search technique uses Boolean operators. When nurses use identified search terms individually in the search process, it can result in the identification of numerous resources that might not be relevant to the identified clinical problem. For example, searching the terms *kidney failure* and *educational session* separately in CINAHL results in the retrieval of more than 12,000 articles. Boolean operators can be used to produce a more manageable and refined list of potential resources. Boolean operators include “AND,” “OR,” and “NOT.” Adding any of these terms to the search process will direct the software, database, or search engine to combine or eliminate elements to make the search more specific.

The Boolean operator “AND” joins search terms and helps to locate references that have both terms. For

example, using *kidney failure* AND *educational session* as the search term identified only four articles. The identified resources contain both concepts and are more likely to be relevant to the identified clinical problem. Including the term “OR” will expand the search by identifying references that contain either term. For example, *kidney failure* OR *renal insufficiency* will produce a search that contains

both. On the other hand, using the Boolean operator “NOT” will exclude terms, for example, *individualized educational sessions* NOT *group educational sessions*.

Boolean operators also can be combined with the search techniques of controlled vocabulary and truncation, thereby further refining the search. Using Boolean operators allows nurses to produce a more manageable and clinically relevant potential list of resources by expanding or excluding relevant terms.

PICOT Search Techniques

PICOT questioning helps guide the search and is particularly useful when searching bibliographic electronic databases such as MEDLINE that allow nurses to search using PICOT formatted items. With this search method, nurses will use each component of the developed PICOT question. To perform a PICOT search, nurses must first access the National Library of Medicine (NLM) website (<http://pubmedhh.nlm.nih.gov/>). From this website, nurses can select from two different search engines. The first option for a PICOT search prompts nurses to enter each identified search term separately. The second option, askMedline, will prompt nurses to enter the PICOT question search terms as free text in narrative format.

Mobile applications that will allow nurses to perform a PICOT search are also available through the NLM website, thus enabling searching anytime and anywhere. **Figures 1-2** illustrate how to use the components of the previously posed PICOT question when performing either search option. However, as was the case with the strategy of controlled vocabulary, nurses may need to consider synonyms of the search terms to broaden the results. Using the PICOT search strategy provides a means for nurses to put together search terms that will facilitate an evidence-based approach for identifying resources.

TABLE 2
ELECTRONIC REFERENCE MANAGEMENT RESOURCES

Software/App	Website	Description	Cost
CiteULike	http://www.citeulike.org	Social reference management website that allows tagging, filing, and sharing of references; makes article recommendations; enables searches of PDFs; extract citation details then use BibTeX to build bibliographies; create groups of users with shared libraries	Free
Endnote (ProCite)	http://www.Endnote.com	Organize and store research articles and notes; group references; annotate PDFs, attach files to references; uses Cite While You Write bibliography creator; collaborate with others; available for MAC or Windows users	\$249.95 download with installation on up to 3 computers
Mendeley	http://www.mendeley.com	Read and annotate PDFs; manage references and generate citations; collaborate with research colleagues and share materials; available for iPhone®, iPad®, and iPod® touch	Free
RefWorks	http://www.refworks.com	Import files from multiple sources to create personal online database that is searchable; create bibliographies; collaborate with others; available as a web-based service across multiple platforms; can be used with mobile phones	\$100 for individual subscription
Zotero	http://www.zotero.org	Collect, tag, organize, and search research materials (including PDFs, audio and video files, or other document formats) in a personal library; create citations; share materials and collaborate with research groups; synchronize data across devices	Free

Limiting the Search

Even when using controlled vocabulary, truncation, Boolean operators, and PICOT format for searching, the resulting literature may still be excessive and provide unnecessary and irrelevant references. Narrowing the search even further can be completed by specifying search limits. In some databases, nurses may be able to specify the type of publication (e.g., clinical trial, meta-analysis, or randomized controlled trial), the language of the publication, the year of publication, or the type of source (e.g., academic journal or dissertations). Only those sources that fit the narrowed search criteria will be identified. This narrowing of the search is particularly helpful for EBP when specific types of references are desired.

MANAGING RETRIEVED RESOURCES

Because searches may yield many relevant resources, continuing education and staff development educators can assist nurses in efficiently managing, organizing, and facilitating the sharing of the retrieved resources. Recent advances in technology provide nurses with numerous options to compile resources in a logical and systematic way that can make sources available for multiple users. **Table 2** provides an overview of select electronic reference management resources. Common features of these tools include:

- Creating a personal library.

- Annotating PDFs.
- Importing and exporting options.
- Collaborating through document sharing.
- Providing online storage with automatic backup.
- Allowing resource access on multiple devices.

These management systems enhance collaboration with other nurses who may be working together on EBP projects.

Managing retrieved resources through use of an electronic reference tool helps nurses streamline the processes involved in completing searches and implementing EBP. For example, when using an electronic management tool, nurses can create folders to organize the retrieved resources related to each search term (e.g., individualized educational sessions or dietary adherence). Nurses can then share the documents with colleagues who are also interested in the identified clinical problem related to patients with kidney failure. Collaborating nurses can add documents and comments as they search for the best evidence for decreasing a patient's fluid gain between scheduled hemodialysis treatments. Finally, many reference management resources can assist with creating properly formatted bibliographies.

CONCLUSION

Nurses face a variety of obstacles when attempting to implement EBP. Frequently, lack of resources and tools to search for and obtain the necessary evidence have been

key points

Evidence-Based Practice Resources

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- 1 Continuing education and staff development professionals can facilitate nurses' development of information literacy skills.
- 2 The use of controlled vocabulary, truncation, Boolean operators, PICOT (Population/Patient Problem, Intervention, Comparison, Outcome, Time) search approaches, and search limits help to improve searches and yield relevant resources for evidence-based nursing practice.
- 3 Electronic reference management resources may aid in collaboration, the review of references, and literature citation.

identified as being barriers. Many health care facilities may not have resources in place to support nurses in performing appropriate searches. The lack of institutional resources places the responsibility of helping staff develop efficient and appropriate information literacy skills with

the continuing education and staff development educators. This article suggests several strategies that nurse educators can use to aid staff in searching and managing EBP resources. By using these search recommendations, nurse educators can serve as a resource for staff nurses while providing a supportive culture for EBP.

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