Evidence-based practice (EBP) is a critical piece of the nursing profession puzzle. Evidence-based practice, which involves using the best available research in conjunction with clinical expertise, is essential to answering clinical questions and providing quality patient care. Thanks to EBP, the days of doing things “the way they have always been done” are long gone. Today’s nurses must find and evaluate evidence to support research projects, solve difficult clinical problems, and justify departmental and institutional policies and procedures.

To find the best evidence, nurses should be adept at searching databases, such as MEDLINE/PubMed and CINAHL. However, many nurses find the process of literature searching to be daunting, which is partly because of the overwhelming amount of biomedical research, which, according to one estimate, increases by thousands of articles per hour. Unease with technology and unfamiliarity with resources are a few more reasons why nurses may shy away from literature searching. Education can improve nurses’ confidence and comfort with using technology, searching databases, choosing appropriate resources, and evaluating evidence.

The purpose of this column is 2-fold. The first is to offer practical tips for performing effective literature searches and choosing the best available evidence. The second is to serve as a toolkit for nurse managers and educators interested in training their staff and colleagues about these topics.

Levels and Types of Research Evidence

Levels of Evidence
Being familiar with the study types that provide the best evidence is helpful before searching the biomedical literature. The evidence pyramid (Figure 1) illustrates studies arranged in a hierarchical fashion. As one moves up the pyramid, the level of evidence and its relevance to the clinical setting increase, whereas available research decreases. Therefore, the medical literature contains far fewer meta-analyses than case reports.

The study types at the top of the pyramid, meta-analyses and systematic reviews, attempt to answer a specific clinical question by synthesizing and appraising all available literature and summarizing the results. The lower portion of the pyramid contains the primary literature, including randomized controlled trials, cohort
Whether one is reviewing the professional literature or looking for evidence to support practice, taking a thoughtful approach to the searching process pays. Jumping right into the search without a clear idea of what, where, or how to search can lead to studies, case-controlled studies, and case studies. For additional information about study types, including a description of each, see Table 1.

Table 1: Description of Study Type

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meta-analysis</td>
<td>Takes a systematic review 1 step further by combining all the results using accepted statistical methodologies.</td>
</tr>
<tr>
<td>Systematic review</td>
<td>Focuses on a clinical question and conducts an extensive literature search to identify studies with sound research methodology. The studies are reviewed and assessed, and the results are summarized according to predetermined criteria.</td>
</tr>
<tr>
<td>Randomized controlled trial</td>
<td>An experimental study using primary data generated in the clinical environment. Individuals similar at the beginning are randomly allocated to 2 or more groups (treatment and control), and the outcomes of the groups are compared after sufficient follow-up.</td>
</tr>
<tr>
<td>Cohort study</td>
<td>Follows a large population with a specific exposure or treatment over time and compares outcomes with another group that has not been affected by the exposure or treatment.</td>
</tr>
<tr>
<td>Case-controlled study</td>
<td>Studies in which patients who already have a specific condition or outcome are compared with those who do not. Researchers look back in time to identify possible exposures.</td>
</tr>
<tr>
<td>Case series or case report</td>
<td>Collections of reports on the treatment of individual patients, or a report on a single patient. Because they are reports of cases and use no control groups with which to compare outcomes, they have no statistical validity.</td>
</tr>
</tbody>
</table>

Note that the higher levels of evidence may not always be available or feasible. For example, new and cutting-edge topics may not have adequate research to warrant a systematic review or a meta-analysis. Also, withholding treatment from 1 group to conduct a randomized controlled trial may not be ethical. In cases such as these, a lower level of evidence is acceptable. Despite the location of case reports and case series on the evidence pyramid, clinicians should not underestimate their significance. Although these study types are considered less useful evidence, they contribute to the body of literature and bolster the need for higher-level studies.

Types of Evidence
Two major categories of evidence are filtered and unfiltered resources. Filtered resources have been evaluated for quality or critically appraised by subject experts. For this reason, filtered resources can help clinicians quickly make evidence-based decisions at the point of care. Examples of filtered resources include clinical guidelines published by professional organizations. Unfiltered resources, on the contrary, have not been appraised or evaluated. As a result, the reader must determine whether the evidence presented is valid. Because unfiltered resources require more time and effort for the reader, they are less ideal than filtered resources at the point of care. For some examples of commonly used filtered and unfiltered resources, see Table 2.
2. Use PICO (or PICOT) to identify key concepts of the question. PICO is a mnemonic device used in EBP to determine the critical aspects of a clinical question. PICO stands for patient (or population or main problem), intervention (or exposure or prognostic factor), comparison, and outcomes. Sometimes, a T will be tacked on to the end of PICO.

1. Begin with a focused topic, statement, or question. When developing a research topic or question, be as specific as possible. The finalized research question should be both searchable and answerable.

Table 2: Filtered and Unfiltered Resources

<table>
<thead>
<tr>
<th>Resource Name</th>
<th>Resource Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cochrane Library</td>
<td>Filtered</td>
<td>Produced by the Cochrane Collaboration, Cochrane Library includes the Cochrane Database of Systematic Reviews. Cochrane reviews follow a rigorous study design and are considered very high-quality evidence. Abstracts of Cochrane systematic reviews are freely available, but a subscription is required for full text. <a href="http://www.thecochranelibrary.com">http://www.thecochranelibrary.com</a></td>
</tr>
<tr>
<td>CINAHL (Cumulative Index to Nursing and Allied Health Literature)</td>
<td>Unfiltered</td>
<td>CINAHL is available by subscription via EBSCO publishing and provides comprehensive coverage of the English language nursing literature as well as alternative and complementary medicine, biomedicine, and consumer health. Different versions of CINAHL are available, including CINAHL with full text, CINAHL Plus, CINAHL Plus with full text, and CINAHL Complete. <a href="http://www.ebscohost.com/biomedical-libraries/the-cinahl-database">http://www.ebscohost.com/biomedical-libraries/the-cinahl-database</a></td>
</tr>
<tr>
<td>DynaMed</td>
<td>Filtered</td>
<td>An evidence-based resource with summaries of more than 3000 clinical topics. DynaMed is intended for use at the point of care to answer clinical questions and is available by subscription from EBSCO publishing. <a href="https://dynamed.ebscohost.com">https://dynamed.ebscohost.com</a></td>
</tr>
<tr>
<td>The Joanna Briggs Institute</td>
<td>Filtered</td>
<td>The Joanna Briggs Institute is a nonprofit, international organization of health care professionals based at the University of Adelaide in Australia. From the Joanna Briggs Institute Web site, visitors can search a library of systematic reviews for nursing and allied health professions. However, to access abstracts or full-text reviews, one must have a subscription (available from Wolters Kluwer/Ovid). <a href="http://www.joannabriggs.edu.au">http://www.joannabriggs.edu.au</a></td>
</tr>
<tr>
<td>MEDLINE/PubMed</td>
<td>Unfiltered</td>
<td>Produced by the US National Library of Medicine, MEDLINE indexes almost 6000 journals and is freely available via the PubMed interface. PubMed contains more than 22 million citations, primarily from allied health, clinical medicine, and nursing journal literature. MEDLINE is also available by subscription from EBSCOhost, Ovid, and ProQuest. <a href="http://www.ncbi.nlm.nih.gov/pubmed">http://www.ncbi.nlm.nih.gov/pubmed</a></td>
</tr>
<tr>
<td>Mosby's Nursing Consult</td>
<td>Filtered/unfiltered</td>
<td>A subscription-based resource from Elsevier, containing evidence-based nursing monographs and clinical practice guidelines to help nurses make sound clinical decisions. Some content in Nursing Consult, such as journals, is unfiltered. <a href="http://www.nursingconsult.com">http://www.nursingconsult.com</a></td>
</tr>
<tr>
<td>Mosby's Index</td>
<td>Unfiltered</td>
<td>Indexes nearly 3000 nursing and allied health journals and contains more than 5 million records dating back to 1974. Mosby's Index is available from Elsevier and requires a subscription. <a href="http://www.mosbysnursingindex.com">http://www.mosbysnursingindex.com</a></td>
</tr>
<tr>
<td>UpToDate</td>
<td>Filtered</td>
<td>An evidence-based resource from Wolters Kluwer that is authored by physicians and intended for use at the point of care to answer clinical questions. Available by subscription only. <a href="http://www.uptodate.com">http://www.uptodate.com</a></td>
</tr>
</tbody>
</table>

results that are overwhelming or irrelevant. The 5 tips given here offer a framework for creating efficient searches that yield highly relevant results.
making it PICOT. The extra letter T represents the type of study that best answers the clinical question. For example, intervention or therapy questions are often best answered with randomized controlled trials or systematic reviews. The PICO structure should guide the search strategy and selection of articles.

3. **Identify appropriate keywords and subject headings.** Keywords may be synonyms, common acronyms, or variations of the major concepts identified in the PICO. Subject headings, or controlled vocabulary, are standardized terms used by a database to describe a topic, which help the searcher find articles about concepts that can be expressed in many different ways. Subject headings also allow for “explosion,” or searching on all narrower concepts in a broad category without having to type in every term. PubMed’s controlled vocabulary is known as Medical Subject Headings (MeSH), whereas CINAHL uses CINAHL Headings. MeSH terms and CINAHL Headings are often, but not always, the same.

4. **Search each concept separately.** Use Boolean operators (OR, AND) to combine search sets. For unfiltered resources, such as PubMed and CINAHL, it is best to search one concept at a time, which allows for flexibility and reuse of sets in multiple ways until the desired search results are retrieved. To combine search sets, use the Boolean operators OR and AND. Use OR to broaden the search and find articles containing any of your terms. AND will help narrow and focus the results, finding only articles with all of the search terms.

5. **Apply filters to focus search results.** Common database filters include English language, age groups, publication dates, and levels of evidence (article types). To ensure that potentially relevant articles are not omitted during the initial search, wait until the end to filter the results to a particular population (eg, children).

**Example**

To better understand these search tips, it may help to see them in action. The following scenario presents a clinical problem, which will help illustrate the 5-step searching process.

**Clinical Scenario**

You work in a medical intensive care unit and have seen firsthand that ventilator-associated pneumonia can lead to greater patient morbidity and increases in length of stay, cost of care, use of antibiotics, and demands on staff. You and your colleagues want to find evidence related to effective oral-care practices that will help you develop an evidence-based strategy for prevention of ventilator-associated pneumonia in critically ill patients being treated with mechanical ventilation.

**Step 1:** Begin with a focused topic, statement, or question

In critically ill patients being treated with mechanical ventilation, what are effective oral-care practices for preventing ventilator-associated events?

**Step 2:** Use PICO(T) to identify key concepts of the question

**Patient:** Critically ill patients being treated with mechanical ventilation.

**Intervention:** Effective oral-care practices.

**Comparison:** None.

**Outcomes:** Prevention of ventilator-associated pneumonia.

**Type of article:** Randomized controlled trial or systematic review.

**Step 3:** Identify appropriate keywords and subject headings

<table>
<thead>
<tr>
<th>PICO</th>
<th>Keywords (Synonyms)</th>
<th>MeSH Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>P: Critically ill patients being treated with mechanical ventilation</td>
<td>Critically ill, Critical illness</td>
<td></td>
</tr>
<tr>
<td>I: Oral care</td>
<td>Oral care, Toothbrushing (as a narrower term of oral hygiene; as a result, the term will automatically be included in a PubMed search for oral hygiene)</td>
<td></td>
</tr>
<tr>
<td>O: Ventilator-associated pneumonia</td>
<td>Ventilator-associated pneumonia, VAP</td>
<td></td>
</tr>
</tbody>
</table>

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Step 4: Search each concept separately. Use Boolean operators (OR, AND) to combine search sets

<table>
<thead>
<tr>
<th>Search #</th>
<th>PubMed Search</th>
<th>Items Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Critical illness OR critical care OR intensive care units</td>
<td>204 130</td>
</tr>
<tr>
<td>2</td>
<td>Oral care OR oral hygiene</td>
<td>70 930</td>
</tr>
<tr>
<td>3</td>
<td>Ventilator-associated pneumonia OR VAP</td>
<td>4820</td>
</tr>
<tr>
<td>4</td>
<td>#1 AND #2 AND #3</td>
<td>176</td>
</tr>
</tbody>
</table>

*PubMed has a unique feature called Automatic Term Mapping, which attempts to find a relevant MeSH term for a user’s query. For example, a PubMed search for ventilator-associated pneumonia will look for these terms as keywords, while also incorporating the MeSH terms, pneumonia, ventilator-associated, into the search.

With the first 4 steps completed, the next step is choosing where to begin the search. If conducting a literature review or looking for evidence to support or affect practice changes, search multiple resources, which will help ensure that relevant articles are not missed. Frequently, searchers begin in MEDLINE because it is a comprehensive biomedical database, containing citations for Cochrane systematic reviews as well as the most important nursing journals. However, there is no right or wrong order, and the databases one searches will depend on the nature of the question being asked.

Step 5: Apply filters to focus search results

<table>
<thead>
<tr>
<th>Search #</th>
<th>PubMed Search*</th>
<th>Items Found</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>#1 AND #2 AND #3</td>
<td>176</td>
</tr>
<tr>
<td>5</td>
<td>#1 AND #2 AND #3, filters: English</td>
<td>166</td>
</tr>
<tr>
<td>6</td>
<td>#1 AND #2 AND #3, filters: systematic reviews, English</td>
<td>33</td>
</tr>
</tbody>
</table>

*PubMed search was performed on March 25, 2013. A video of this search can be viewed online at http://www.screencast.com/t/i4jMjuo6.

Evaluating Research: A Primer

Now that the searching process is complete, the next step is to scan the results and find relevant articles. Not all published research is of good quality, so the reader must decide whether a study has valid or trustworthy results. To establish a study’s validity, one must determine that its research methodology is sound, which can be accomplished by asking some basic questions when reading an article. The following questions, which are adapted from Evidence-Based Practice Across the Health Professions, and Users’ Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice, can be used to evaluate systematic reviews:

- Does the review ask a clear, focused clinical question?
- Are there explicit eligibility criteria included in the review?
- Did the authors conduct a thorough, comprehensive literature search that is reproducible?
- Are the studies included in the review of high quality? Did they follow a rigorous research methodology (e.g., randomized controlled trials)?
- How are the articles in the review selected and assessed? Is this assessment included in the review? Is it reproducible?
- What are the results of the review? How precise are these results?
- How do the results affect clinical practice? Can the results be applied to my practice?

In addition to these questions, many tools are available to aid readers with evaluating research. Here are a few resources that are freely available: Critical Appraisal Sheets from the Centre for Evidence-Based Medicine (http://www.cebm.net/index.aspx?o=1157) and Critical Appraisal—Notes and Checklists from the Scottish Intercollegiate Guidelines Network (http://www.sign.ac.uk/guidelines/fulltext/50/annexc.html).

Conclusion

In the future, when embarking on a research study or project, try following the 5-step searching process, which will help focus the research question, leading to more manageable and relevant search results. Although this column provides useful tips for finding and evaluating research, it is just the tip of the iceberg. For additional information or training on these topics, contact a medical librarian.

REFERENCES


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