Symposium Papers

How to Find the Best Evidence

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The Internet has made finding evidence for clinical practice fairly easy. Many different types of databases that can be searched for relevant key terms are available for free or for subscription. Bibliographic or library databases contain books, book chapters, reports, citations, abstracts, and either the full text of the articles indexed or links to the full text. Citation databases are specially designed so that you can track the progress of an idea or research topic by searching the published works that cite a particular author or article. Synthesized databases are pre-filtered records for particular topics. They are usually subscription-based, with relatively large fees (but you can get free access in libraries). This type of database may provide the "best" evidence without extensive searches of standard bibliographic databases. Portals are Web pages that act as a starting point for using the Web or Web-based services and links to books, journals, patient-education resources, and images. Many medical journals, including RESPIRATORY CARE, **are now available online. Finally, even generalized search engines such as Google, Yahoo, Ask, and Dogpile can provide a wealth of information on medical topics.** *Key words: evidence, Internet, database, index, research, bibliography, Web, books, journals, search engine.* [Respir Care 2009; 54(10):1360–1365. © 2009 Daedalus Enterprises]

Introduction

As a respiratory therapist, one of your primary responsibilities is to "Actively maintain and continually improve [your] professional competence."[1] A key skill required to sustain this ethic is the ability to find the data required to make informed decisions about best practice. In this paper I will present a brief overview of the many sources of data available for determining the best evidence for medical practice and some introductory instruction in how to use them.[2,3] Remember, data are just facts; data that impart meaning constitute information; information used is knowledge.

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Databases

A database is a structured collection of facts. A list of names and telephone numbers on a piece of paper is a database. A spreadsheet containing a business profit and loss statement is a database. And of course, a project created with a software database design program (eg, Microsoft Access) is a database. The structure is called the database model (eg, a relational model), but the specifics are beyond the scope of this article. Part of the database structure is the *index*, or mechanism for locating specific data and for enforcing rules, such as preventing duplicate entries. Data are often indexed using a *controlled vocabulary*, which is a carefully selected set of words and phrases, such that each concept is described using only one term in the set and each term in the set describes only one concept. For example, an article about continuous positive airway pressure (CPAP) might be indexed using a hierarchical controlled vocabulary such as:

1.0. Therapeutics
  1.1. Respiratory Therapy
    1.1.1. Respiration, Artificial
      1.1.1.1. Positive-Pressure Respiration
        • Continuous Positive Airway Pressure

The power of the computer has allowed us to create gigantic databases with very complex structures. Such databases allow us to define many different ways of relating the data (ie, creating meaning, or information), to find that information more quickly than any other time in history, and to display it in whatever form we can imagine. There are 3 basic database categories commonly used for storing medical data: bibliographic, citation, and synthesized.

Bibliographic Databases

A bibliographic, or library, database contains books, book chapters, reports, citations, abstracts, and either the full text of the articles indexed or links to the full text. Perhaps the most popular bibliographic database is PubMed (http://www.ncbi.nlm.nih.gov/sites/entrez?db=pubmed), a service of the United States National Library of Medicine that includes over 18 million citations from MEDLINE and other life science journals for biomedical articles back to 1948. PubMed includes links to full-text articles and other related resources in medicine, nursing, dentistry, veterinary medicine, health-care systems, and preclinical sciences. It provides a Clinical Queries search filters page as well as a Special Queries page. The site also provides automatic e-mailing of search updates, the ability to save records, and filters for search results using "My NCBI." Figure 1 shows the home page for PubMed and the location of the links to frequently asked questions (FAQ) and tutorials. Figure 2 shows initial search results on the term CPAP. Notice that there are 176 pages of results, far too
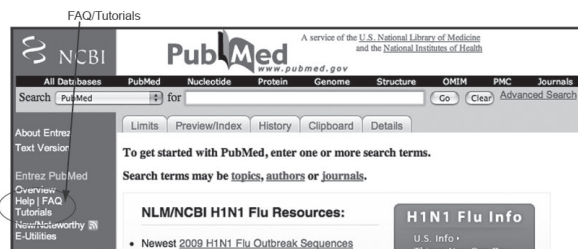

Fig. 1. The home page for PubMed and the location of the links to frequently asked questions (FAQ) and tutorials
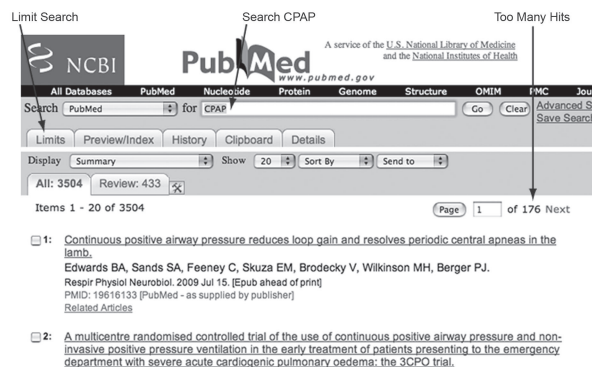

Fig. 2. Initial results from a search on continuous positive airway pressure (CPAP). The arrows indicate that there are too many hits on the search term, so we will have to use the Limits tab to narrow the search.

many to manage effectively. The remedy is to use the Limits tab (shown in Fig. 2) to narrow the search. Figure 3 shows the search filter criteria on the Limits tab. Here we have limited the search on CPAP to full-text, editorial references only, published within the last 10 years. Figure 4 shows the results of the limited search. Note that we now have only one page of results. Further searches on related topics are easily done by simply clicking on the Related Articles link. The search results can be sorted several ways; I like to sort by publication date so that I can quickly see the most recent articles (Fig. 5). PubMed also lets you save your search results in a variety of ways. Figure 6 shows how to save the desired results (ie, those that you check-marked) into a text file that you can print or save to your desktop.

Another free bibliographic medical database you should know about is SearchMedica (Fig. 7). According to the SearchMedica Web site (http://www.searchmedica.com):

> SearchMedica . . . (delivers) only the most clinically reputable content intended for practicing medical clinicians. With guidance from our advisory board of specialty physicians and our staff editors, Search-Medica scans well-known, credible journals, systematic reviews, and evidence-based articles that are written and edited for clinicians practicing in primary care and all major specialties. Using sim-
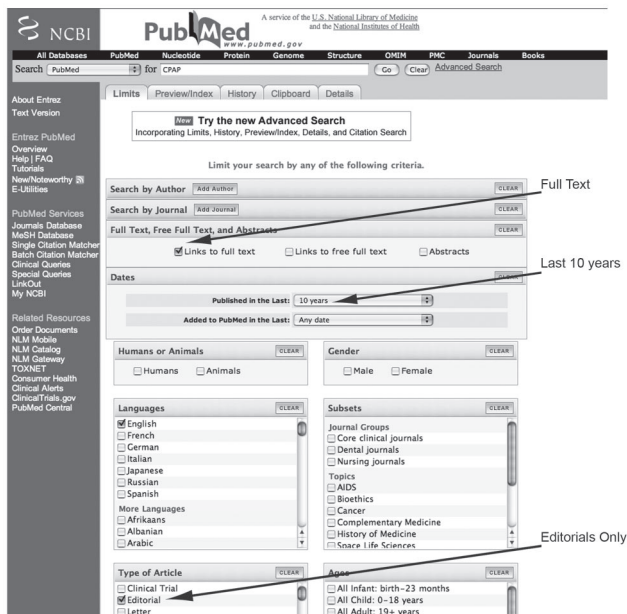
Fig. 3. The search filter criteria on the Limits tab. The arrows show how we have limited the search on continuous positive airway pressure (CPAP) to full-text, editorial references only, published within the last 10 years.
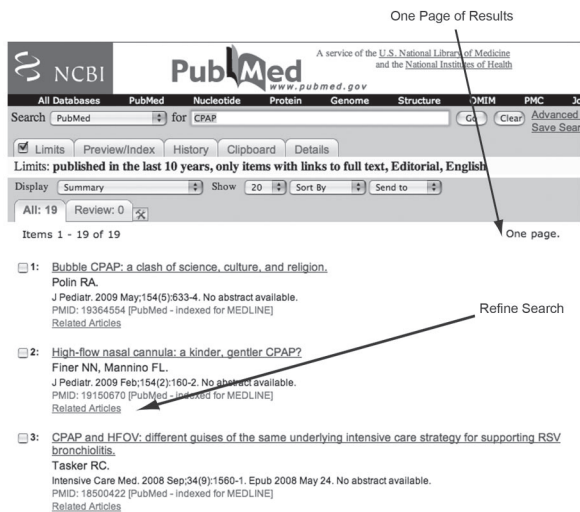

Fig. 4. The results of the limited search. You can perform another search, limited to topics related to continuous positive airway pressure (CPAP) by clicking on the Related Articles link.
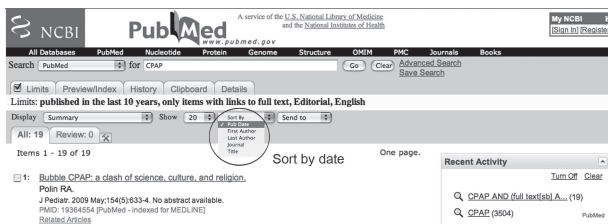

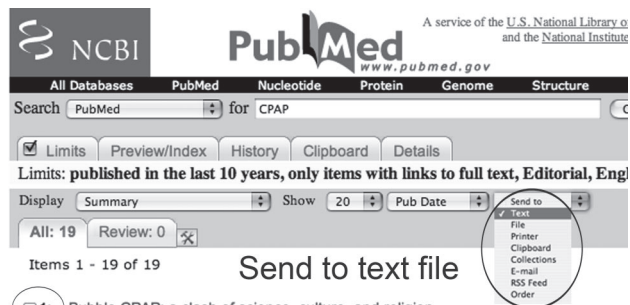Fig. 5. Sorting the search results by publication date.

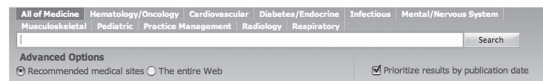Fig. 6. Saving selected search results to a text file.

Fig. 7. SearchMedica home page.

ilar expertise, SearchMedica also selects and scans patient-directed Web sites, online CME [continuing medical education] courses, and government databases of clinical trials and practice guidelines.

Citation Databases

A citation database is specially designed so that you can track the progress of an idea or research topic by searching the published works that cite a particular author or article. The most popular citation database is probably the Thomson Reuters ISI Web of Knowledge (http://isiwebofknowledge.com). This service includes 700 million cited references from 23,000 journals covering 256 scientific disciplines. It has access to 9,000 Web sites, 110 conference proceedings, 23 million patents, and over 100 years of back files. Figure 8 shows how I set up a search on my name as an author of published articles. Figure 9 shows the results. Notice that this page also lets you refine the search by selecting criteria, such as subject area and document type. In this case I selected reference 5, "A New System for Understanding Nebulizer Performance" (Fig 10). Other biomedical databases, among many, are the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (http://www.ebscohost.com/cinahl/); ScienceDirect, which provides articles from Elsevier journals (http://www.sciencedirect.com/); IngentaConnect (http://www.ingentaconnect.
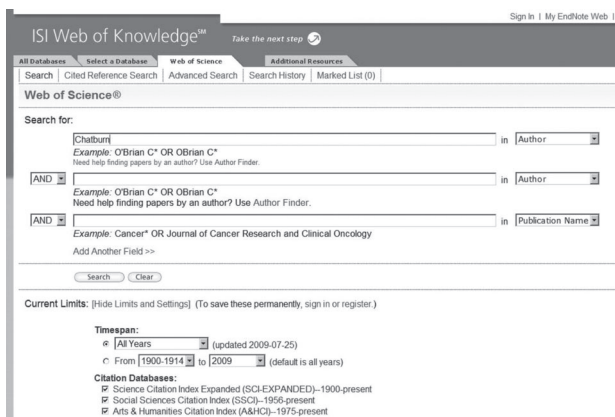
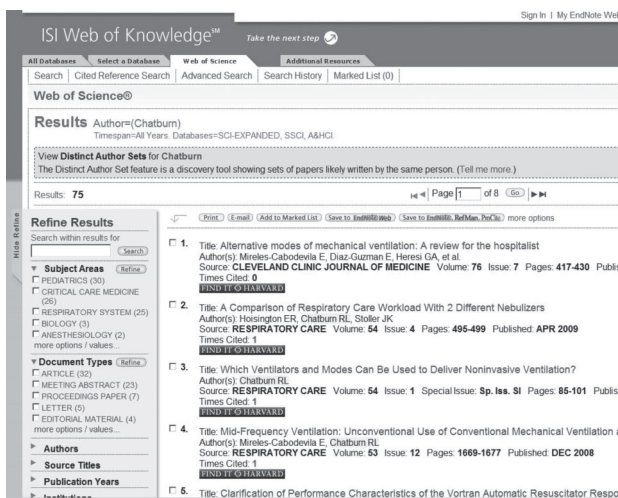Fig. 8. Web of Knowledge search on author name Chatburn.

Fig. 9. Results from Web of Knowledge search.
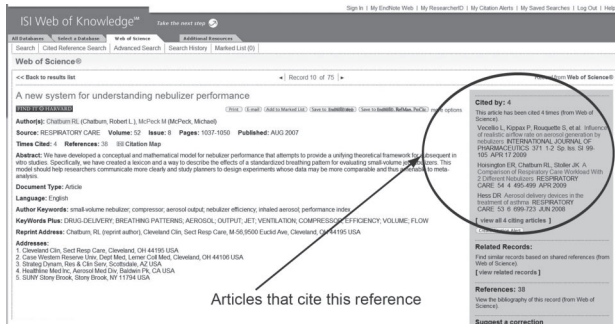

Fig. 10. Articles that cite reference 5 from Figure 9.

Fig. 11. The Cochrane Collaboration home page.

com/); HighWire Press (http://highwire.stanford.edu/) a division of Stanford University Libraries; and EMBASE (http://www.embase.com/), which specializes in its coverage of pharmaceutical research.

Synthesized Databases

Synthesized databases are pre-filtered records for particular topics. They are usually subscription-based, with relatively large fees. This type of database may provide the "best" evidence without extensive searches of standard bibliographic databases. The leading database in this category is the Cochrane Collaboration (http://www.cochrane.org). Figure 11 shows how a search on CPAP would look using this database. Cochrane reviews are designed to be exhaustive reviews of the literature on a given topic. The results provide a comprehensive analysis of the existing evidence and are presented in the following format:

- Objectives (of the review)

- Search strategy (eg, databases used)

- Selection criteria (types of studies included in the reviews, such as randomized controlled trials)

- Data collection and analysis (eg, emphasis on allocation concealment, adherence to intention-to-treat principle)

- Main results (eg, number of studies included in the report, total number of patients studied, statistical meta-analyses)

- Authors' conclusions (a concise statement of the take-home message)

UpToDate (http://www.uptodate.com) is another synthesized database. This is another subscription-based service that claims to be the largest clinical community in the world dedicated to synthesizing knowledge for clinicians and patients. It has 3,800 expert clinicians who function as authors, editors, and peer reviewers, and 320,000 users, who provide feedback and questions to their editorial group. They cover 7,400 topics in 13 medical specialties. The service provides graded treatment recommendations based on the best medical evidence.

Figure 12 shows yet another search on CPAP, using UpToDate. The interesting thing about the search results (Fig. 13) is that when you put your cursor over one of the entries, its outline is shown in the box on the right. Clicking on the reference brings up the text of the article. Another unique feature of this service is the Patient Info tab (see Fig. 13). Clicking on this brings up a path to a host of related information you can give to patients.

There is a free synthesized database you may find useful: the National Guideline Clearinghouse (http://www.
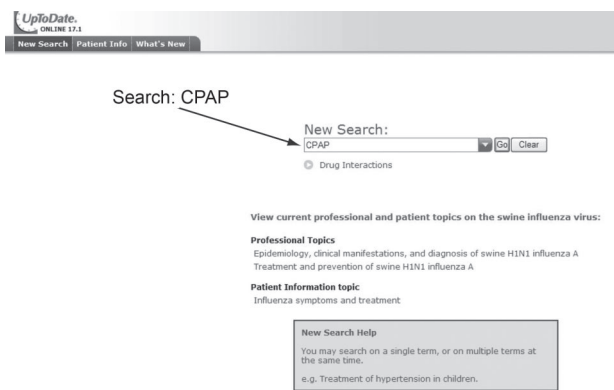
Fig. 12. A search on the term continuous positive airway pressure (CPAP) using UpToDate.
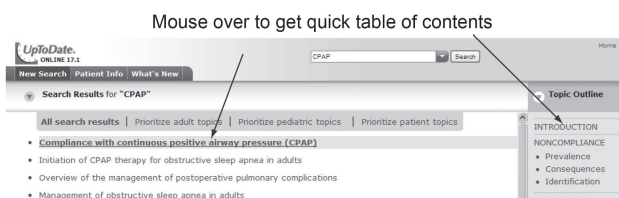
Fig. 13. UpToDate search results.
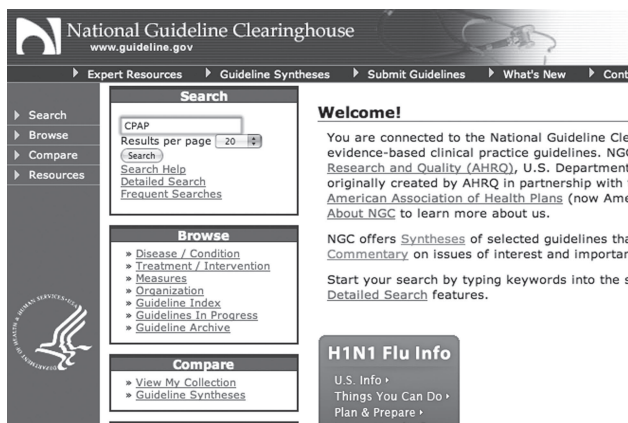

Fig. 14. National Guideline Clearinghouse home page.

Fig. 15. National Guideline Clearinghouse search results.

Fig. 16. RESPIRATORY CARE contents page.

guideline.gov). Figure 14 shows the home page. Figure 15 shows the results page.

Portals

Portals are Web pages that act as a starting point for using the Web or Web-based services. One example of a subscription-based service is MDConsult (http://www.mdconsult.com), which provides links to books, journals, Clinics in Medicine, patient-education resources, and images. Another example is Ovid, which provides links to books, journals, evidence-based medicine databases (eg, Cochrane Collaboration), and the Cumulative Index to
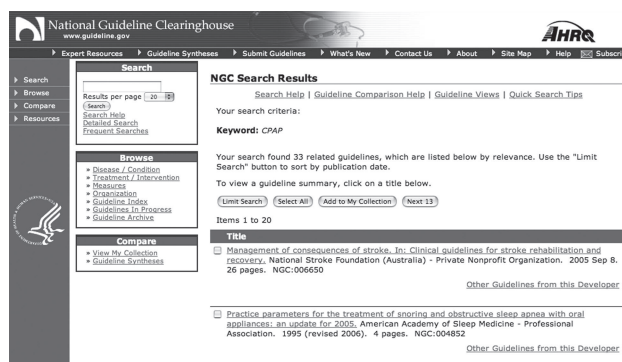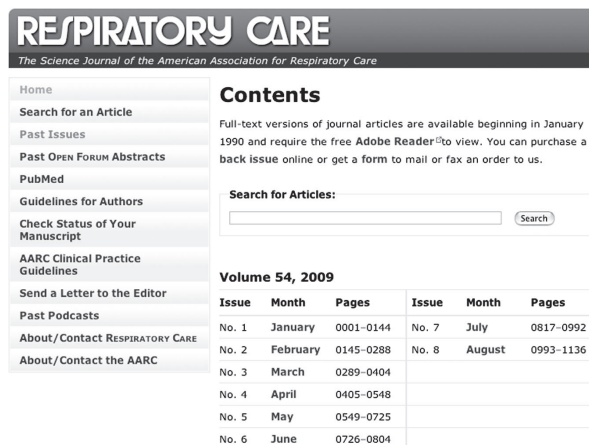
Nursing and Allied Health Literature (CINAHL). Most medical libraries will have subscriptions to both of these services.

Electronic Journals and Books

Many medical journals are now available online. You should be most familiar with our own RESPIRATORY CARE (http://www.rcjournal.com). Full-text versions of Journal articles are available back to January of 1990. OPEN FORUM abstracts (ie, abstracts presented at the annual American Association for Respiratory Care meeting and published usually in the November issue of RESPIRATORY CARE) dating back to 1997 are also available. The contents page contains a wealth of information for potential authors (Fig. 16).

There are many electronic versions of textbooks available on the Internet. From the PubMed home page, select Search Books from the drop-down menu (instead of Search PubMed), enter a search term, and you will get a results page with tabs for books and figures from books. Subscriptions services include Oxford Reference Online (http://

oxfordreference.com), STAT!Ref (http://statref.com) (great source for nursing and drugs), and Safari Books Online (http://safaribooksonline.com) (excellent source of technical reference books). Again. your medical library will probably have subscriptions to these services.

Google (http://www.google.com) will let you search for books too. Just select the *more* link at the top of the page and then select Books. Another great book resource is Amazon (http://www.amazon.com). These books are all for sale, but many times you can find them (even those out of print) used, for a small fraction of their original cost. If you don't want to buy, just use Amazon to get ideas before you go to the library.

General Internet Resources

There are many free search engines of which you are probably already aware. Sites such as Google, Yahoo (http://www.yahoo.com), AltaVista (http://www.altavista.com), and Ask (http://www.ask.com) are all useful. But remember, these sites use proprietary search algorithms rather than controlled vocabularies like PubMed. As a result, you are likely to get unexpected results. You might also consider so called meta-search engines that transmit your search terms simultaneously to several individual search engines. Some examples of these are Clusty (http://clusty.com), Dogpile (http://dogpile.com), and Surfwax (http://surfwax.com).

Suggestions for Conducting Searches

The first and most important suggestion I can offer is to talk to a professional librarian. These people can show you all the tricks of the trade—things you never imagined could be done. And in some cases they will even do the search

Table 1. Checklist for Conducting Online Searches for the Best Evidence

Understand your topic (eg, the basic concepts and relevant terminology) before getting started.
Start with review articles and look at their reference lists.
Use the key words from relevant articles as your search terms. Be specific. At PubMed learn about Medical Subject Headings (MeSH) terms, used by the United States National Library of Medicine to index articles in Index Medicus and MEDLINE.
Use the Related Articles links at PubMed and other sites to help guide your search.

for you. Some libraries offer free courses on how to use all kinds of software tools for conducting searches. Aside from that, use Table 1 as a checklist for conducting your search.

Finally, buy and use bibliographic software such as EndNote (http://www.endnote.com) or RefWorks (http://www.refworks.com). You might also consider Zotero (http://www.zotero.org), a free Firefox (Web browser) extension to help you collect, manage, and cite your research sources. These programs let you import the results of your reference searches into your own database for future use. If you are an author, they will also help you manage the references in your manuscripts. Programs like these will save you a lot of time and effort.

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