Information Retrieval in Respiratory Care: Tips to Locate What You Need to Know

Dean R Hess PhD RRT FAARC

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We need current information to support effective practice. This information can be accessed relatively quickly and inexpensively, using nothing more than a computer and an Internet connection. This demands skills in searching and accessing that information. In many hospitals, computers with an Internet connection are readily available in the clinical wards, allowing those with skills in retrieving medical information to find that information near the bedside where it is needed. This report describes techniques to access information on the Internet from various sources. This information exists at high levels, such as PubMed, the National Guideline Clearinghouse, and the Cochrane Library. However, there is also much information available on the Internet that has not been validated or subjected to peer review. Thus, it is important not only to find information but also to separate useful from useless information. Key words: PubMed, MEDLINE, Internet, research, information science, computers, information services. [Respir Care 2004;49(4):389–399. © 2004 Daedalus Enterprises]

Introduction

More than any time in the history of respiratory care, we need current information to support effective practice. Moreover, new information is increasing rapidly, making it increasingly difficult to stay abreast of the newest valid information. Although textbooks are valuable sources of facts for students, they are quickly outdated, and clinicians are commonly frustrated when using textbooks to search for new information. Despite the rapid pace of new information, increasingly this information can be accessed relatively quickly and inexpensively, using nothing more than a computer and an Internet connection. This demands a
whole new set of skills for searching and accessing that information. In many hospitals, computers with an Internet connection are readily available in the clinical wards, allowing those with skills in retrieving medical information to find that information near the bedside where it is needed. Thus, the latest information can be quickly translated into patient care. I describe here some techniques to find information via the Internet.

**World Wide Web Search**

The Internet and the World Wide Web (or simply, the Web) are separate entities, although commonly used interchangeably. Technically, the Internet is a confederation of networks around the world that allows computers connected to the Internet to communicate with other computers across the Internet. The World Wide Web is an information-sharing protocol that uses the Internet to transmit data. The Web uses browsers such as Internet Explorer and Netscape to access documents called Web pages that are linked to each other via hyperlinks. The Web is only one of the ways that information is disseminated across the Internet. The Internet (but not the Web) is also used for e-mail, news groups, and instant messaging.

A common method to find information, used by millions of people every day, is the basic Web search—so-called “surfing the information superhighway” or simply “surfing the Web.” All that is needed is a computer, an Internet connection, and a search engine. Many search engines are available free of charge, and the choice of one over the other is based on personal preference. The term “search engine” is used generically to describe both “crawler”-based search engines and human-powered directories. Crawler-based search engines such as Google create their listings automatically. The “crawler” (also known as a “spider”) automatically searches the Web and creates an index of everything it finds, and that index allows the average Internet user to rapidly find and access sites of interest via hypertext links. A human-powered directory depends on people for its listings. A short description for the site is written to the directory. The search looks for matches only in the submitted descriptions. In the early days of Web searching, a search engine presented either crawler-based results or human-powered listings. It is now common for both results to be presented.

Crawler-based search engines have 3 major elements. First is the crawler, which visits a Web page, reads it, and then follows links to other pages within the site. The crawler returns to the site on a regular basis to look for changes. What the crawler finds goes into the second part of the search engine, the index. The index, or catalog, contains a copy of every Web page the crawler finds. If a Web page changes, the catalog is updated with the new information. The third part of a search engine is the program that searches the index in response to a user-requested search and ranks the pages found by order of relevance. Although all crawler-based search engines have these basic parts, they differ in how the parts are assembled, which explains why the same search using different search engines often produces different results.

To determine relevancy, a search engine follows a proprietary algorithm. The main factors in a ranking algorithm are the location and frequency of the searched-for terms on the Web page. Pages with the search terms appearing in the title are deemed more relevant. Search engines also check whether the search words appear near the top of a Web page (eg, in the first few paragraphs of text). The other major factor that search engines use to determine relevancy is how often the search terms appear in relation to other words in a Web page. Those with a higher frequency are often deemed more relevant. Some search engines index more Web pages than others, and some index Web pages more often than others. The result is that no search engine has the exact same collection of Web pages to search. A query on a crawler-based search engine often turns up thousands of matching Web pages. In many cases only the 10 most relevant matches are displayed on the first page.

A commonly used search engine, and a favorite of mine, is Google (http://www.google.com). To search the Web using Google, type a few descriptive words into the query box and press the “Enter” key (or click on the Google Search button) for a list of relevant Web pages (Fig. 1). Since Google returns only Web pages that contain all the words in the query, refining or narrowing the search is done by adding more words to the search terms. The result is a smaller subset of the pages found by Google for the original broad query. It is important to choose key words carefully:

- Try the obvious first. For information on noninvasive positive-pressure ventilation, enter “noninvasive ventilation” rather than “mechanical ventilation.”
- Use words that are likely to appear on a Web site with the information you want. “BiPAP” gets more specific results than “equipment for noninvasive ventilation.”
- Chose key words that are as specific as possible. “Noninvasive positive-pressure ventilation” gets more relevant results than “positive-pressure ventilation.”

Because Google returns only pages that include all of the search terms, there is no need to include “and” between search terms. Google ignores common words and characters (eg, “where” and “how”), certain single digits, and single letters, because they slow the search without improving the results. Google indicates if a common word has been excluded by displaying details on the results page below the search box. If a common word is essential to
Fig. 1. A Google search of the Web. A: Enter search term. B: Search results. More information is obtained by clicking on the hypertext links. C: Example of results of a Google Directory search in the topic of pulmonary medicine. (Courtesy of Google.)
obtain the desired results, it can be included by putting a “+” sign in front of it. Another method for doing this is conducting a phrase search, in which quotation marks are placed around 2 or more words. The common words in a quotation-marked phrase (eg, “how to choose a ventilator”) are included in the search. Google searches are not case-sensitive: “noninvasive ventilation” and “NonInvasive Ventilation” return the same results. Google does not use “stemming” or support “wildcard” searches. Google searches exactly the words that you enter in the search box: “blood*” will not yield “blood gas” or “bloodstream” or “bloodborne.”

The Google Web Directory (http://directory.google.com/) can be used to decide which search words to use. For example, searching within the Health > Medicine > Medical Specialties > Pulmonary Medicine category of the Google Web Directory returns a different result than a general Web search. Searching within a category of interest allows you to quickly narrow in on only the most relevant pages.

Conducting a Web search is a quick way to find lots of information. In fact, the amount of information obtained can be overwhelming and involve a considerable amount of time filtering through Web pages and hypertext links. It is not unusual to follow a link to a page that is no longer available (dead link). Much of the information that is found may be irrelevant. Moreover, the validity of information may be suspect. Information posted on the Web may be outdated or incorrect; it is almost never subjected to peer review.

The quality of health-related information on the Internet has been called into question. There is concern about the potential of harm related to poor-quality information on the Internet. Crocco et al conducted a systematic review to evaluate the number and characteristics of reported cases of harm associated with the use of health information on the Internet. Three articles (of 186 reviewed) met the search criteria. One described 2 cases of emotional harm related to improper Internet searches, the second described dogs being poisoned because of information received on the Internet, and the third described hepatic failure in an oncology patient who obtained misinformation about the use of medication on the Internet. This low rate of reported cases of harm associated with the use of health information from the Internet may be due either to an actual low risk for harm or to underreporting of cases; which of these is the case is not known.

Eysenbach et al conducted a systematic review of studies of the quality of health information on the Internet. They included published and unpublished empirical studies in any language in which investigators searched the Internet systematically for specific health information, evaluated the quality of sites or pages, and reported quantitative results. Seventy-nine studies met those criteria. The studies evaluated 5,941 health Web sites and 1,329 Web pages, and they reported 408 evaluation results of 86 different quality criteria. The most frequently used quality criteria were accuracy, completeness, readability, design, disclosures, and references provided. Of the 79 studies reviewed, 55 (70%) concluded that quality is a problem on the Internet, 17 (22%) remained neutral, and only 7 (9%) came to a positive conclusion relating to health information on the Internet. Positive studies scored significantly lower in search (p = 0.02) and evaluation (p = 0.04) methods. The authors concluded that operational definitions for the quality of health-related information on the Internet are needed.

Different types of systems, at various levels, can be used for quality control of information on the Internet. These range from uncontrolled information (by and large the present state) to full centralized control of information (unlikely to ever occur). Information on the Internet can be filtered using either upstream filtering or downstream filtering. With upstream filtering, third parties set quality criteria and perform the evaluation. With downstream filtering the user selects the filter criteria. There are advantages and disadvantages with either approach. With downstream filtering, the user manually checks each site, using a priori criteria, which can be very time-consuming. There are now more than 100 instruments to rate the quality of health information on the Internet. These have been reviewed by Jadad and Gagliardi. Although many incompletely developed instruments exist on the Internet, fewer than 10% of these describe how they were determined to be reliable and valid. More important, it can be questioned whether these instruments should exist in the first place, whether they measure what they claim to measure, or whether they lead to more good than harm.

Internet users often do not assess the quality of information they retrieve. Most do not try to learn about the authors or owners of a Web site and do not read disclaimers or disclosures about the site. Few users later remember from which Web sites they retrieved information. Several criteria have been described to assess the quality of information on a Web site. These include the benchmarks proposed by Silberg et al in JAMA and the Health on the Net Foundation. The benchmarks described by Silberg et al are: (1) display of authorship of medical content, (2) source (attribution or references), (3) date of update, and (4) disclosure of ownership, sponsorship, advertising policies, or conflicts of interest. Table 1 shows the Health on the Net code of conduct for medical and health Web sites. Those criteria should be useful guidelines for both developers and users of Internet sites. Interestingly, it has been reported that Web site popularity might relate more to the type of the site than the quality of the content. In the same study it was reported that commercial sites contain inaccurate statements more often than sites of professional
groups or of organizations, and higher-quality sites (ie, those that had ≥ 3 of the JAMA benchmarks) were less likely to contain inaccurate information than lower-quality sites (ie, those with < 3 of the JAMA benchmarks) (1/64 vs 11/120, p = 0.047). None of the sites that met all 4 JAMA benchmarks contained inaccurate information.

Patients commonly consult the Internet for health-related information. Health care providers should recognize this fact and be prepared to offer suggestions to patients related to Internet-based resources and help patients evaluate the quality of medical information available on the Internet. Patients who use the Internet for health-related information tend to be more educated and to have higher incomes.14 These demographics have raised a concern related to an information and digital divide between patients who have access to the Internet and those who do not.15

An example of how the Internet has facilitated rapid access to medical information is the outbreak of severe acute respiratory syndrome (SARS). I first learned of SARS while casually reading the postings on a Listserv (see description of Listservs below). Within a month of that time I received notice via the e-mail list of The New England Journal of Medicine of 2 publications that were posted on that journal’s Web site.16 In a matter of weeks additional manuscripts were reviewed, revised, and published by The New England Journal of Medicine. Information on SARS is now widely available on the Internet, including Web links from professional organizations such as the American Association for Respiratory Care (AARC, at http://www.aarc.org/resources/sars).

**MEDLINE and PubMed**

MEDLINE is the National Library of Medicine database of indexed journal citations and abstracts.17 It covers over 4,600 journals published in the United States and foreign countries. MEDLINE includes references to articles indexed from 1966 to the present and has been available for online searching since 1971. All citations in MEDLINE are assigned medical subject heading (MeSH) terms from the National Library of Medicine controlled vocabulary. The subject scope of MEDLINE is biomedicine and health. The majority of the publications covered in MEDLINE are scholarly journals, most of which are selected for MEDLINE based on advice received from the Literature Selection Technical Review Committee of the National Institutes of Health. Citations from journals selected via this mechanism also appear in the printed Index Medicus.

MEDLINE citations and abstracts are available as the primary component of the PubMed database searchable via the Internet (http://www.pubmed.gov).18 PubMed also provides citations before the date that a journal was selected for MEDLINE indexing. PubMed provides access to over 12 million MEDLINE citations dating to the mid-1960s and includes links to many sites that provide full-text articles and other related resources. An

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**Table 1. Health on the Net Foundation Code of Conduct for Medical and Health Web Sites**

| Authority | Any medical or health advice provided and hosted on this site will be given only by medically trained and qualified professionals unless a clear statement is made that a piece of advice offered is from a non-medically-qualified individual or organization. |
| Complementarity | The information provided on this site is designed to support, not replace, the relationship that exists between a patient/site-visitor and his/her existing physician. |
| Confidentiality | Confidentiality of data relating to individual patients and visitors to a medical/health Web site, including their identity, is respected by this Web site. The Web site owners undertake to honor or exceed the legal requirements of medical/health information privacy that apply in the country and state where the Web site and mirror sites are located. |
| Attribution | Where appropriate, information contained on this site will be supported by clear references to source data and, where possible, have specific HTML links to those data. The date when a clinical page was last modified will be clearly displayed (eg, at the bottom of the page). |
| Justifiability | Any claims relating to the benefits/performance of a specific treatment, commercial product, or service will be supported by appropriate, balanced evidence. |
| Transparency of authorship | The designers of this Web site will seek to provide information in the clearest possible manner and provide contact addresses for visitors who seek further information or support. The Webmaster will display his/her e-mail address clearly throughout the Web site. |
| Transparency of sponsorship | Support for this Web site will be clearly identified, including the identities of commercial and noncommercial organizations that have contributed funding, services, or material for the site. |
| Honesty in advertising and editorial policy | If advertising is a source of funding, it will be clearly stated. A brief description of the advertising policy adopted by the Web site owners will be displayed on the site. Advertising and other promotional material will be presented to viewers in a manner and context that facilitates differentiation between it and the original material created by the institution operating the site. |

*HTML = hypertext markup language*

(From http://www.hon.ch/honcode/conduct.html)
example is Respiratory Care Journal, for which citations appear that predate the Journal’s acceptance into MEDLINE. PubMed, available via the Entrez retrieval system, was developed by the National Center for Biotechnology Information at the National Library of Medicine, which is located at the National Institutes of Health. Entrez is the text-based search and retrieval system used at the National Center for Biotechnology Information for all major databases, including PubMed. Publishers participating in PubMed electronically submit their citations to the National Center for Biotechnology Information prior to or at the time of publication. If the publisher has a Web site that offers full-text of its journals, PubMed provides a link to that site.

PubMed provides basic citation information and abstracts before the citations are indexed with MeSH terms and added to MEDLINE. New in-process records are available in PubMed daily and display with the tag [PubMed - in process]. New citations that have been indexed with MeSH terms display with the tag [PubMed - indexed for MEDLINE]. Citations received electronically from publishers appear in PubMed with the tag [PubMed - as supplied by publisher].

Searching PubMed is relatively simple and a detailed tutorial is available on-line (at http://www.nlm.nih.gov/bsd/pubmed_tutorial/m1001.html). Medical librarians can also provide help in searching PubMed, and many medical libraries provide tutorials. To search PubMed enter search terms in the query box (Fig. 2). The search rules are straightforward and provided clearly below the query box:

- Enter one or more search terms, or click Preview/Index for advanced searching
- Enter author names in the format “Jones RS” (initials are optional)
- Enter journal titles in full or with MEDLINE abbreviations. Use the Journals Database to find journal titles.

Before beginning the search it is useful to first develop a search strategy. A search strategy is a plan that helps identify the information needed. First, identify the key concepts and search those terms. Then consider alternative terms and search those. It may then be useful to refine the search to dates, study groups, and other limits as appropriate. The Boolean operators “AND,” “OR,” and “NOT” can be used to refine the search. There is no right or wrong way to do a search. Search strategies differ according to personal choice, and efficient searching requires practice and a systematic approach.

The Features Bar, just below the query box, can be used to select additional functions:

- Limit searches to specific fields, age groups, gender, type of study, Entrez or publication date, a specific language, types of articles, or subsets
- Use the Preview/Index feature to preview the number of search results before displaying the citations, or view and select terms from the Index
- Use the History feature to view and combine your previous search queries
- Use the Clipboard feature to collect selected citations from one or several searches for further action
- Use the Details feature to view your search strategy as it was translated by PubMed

The Related Articles feature in PubMed uses a word-weighted algorithm to compare words from the Title and Abstract of each citation, as well as the MeSH headings assigned. The best matches for each citation are precalculated and stored as a set. The Links pull-down menu provides access to a number of links between records in the Entrez databases. All links, except for Related Articles, are included in the pull-down menu. LinkOut provides external links from PubMed citations to provider Web sites for full-text journal articles, biological data, sequence centers, and other sources of data from third parties.

By clicking the authors’ hypertext link it is possible to view the abstract and to see if there is a link to the full-text article. The icon next to the citation also identifies whether the article is available as free full-text. A direct link between PubMed and the journal allows easy access to the full-text article if it is available.

Ovid

Ovid (http://www.ovid.com) provides medical information services to individuals in medical schools, hospitals, and academic institutions. Founded in 1988 as a small, software start-up, Ovid has grown into a world leader in information access, providing electronic content, research capabilities, and support services. In 2001 Ovid merged with SilverPlatter, uniting the resources of two of the leading names in medical and scientific research.

Ovid Web Gateway is Ovid’s most popular interface. Accessed using a Web browser, it allows immediate, easy access to information. Ovid Web Gateway delivers integrated content to the desktop, including over 80 commercial bibliographic databases, more than 1,500 journals, hundreds of full-text journals, books from dozens of publishers, and a full range of search and retrieval features. Ovid Web Gateway’s interface is highly intuitive because it is accessible through graphical interface components. Full-text articles can be displayed with graphics in context and hypertext-linked outlines.
that allow easy navigation through journal issues and tables of contents. Citation manager and other controls allow users to sort and display results for viewing on screen, printing, saving, and e-mailing.

Journals@Ovid is one of the largest single-database aggregations of 100% searchable scientific, technical, and medical full-text journals. Ovid is a subscription service available to many clinicians via institutional subscription managed by the hospital library. One mouse click links key bibliographic databases to full-text articles. Ovid offers the definitive resources in medicine and nursing, including MEDLINE, EMBASE, and Evidence-Based Medicine Reviews.

Professional Organizations

Every professional organization has a Web site. The AARC’s Web address is http://www.aarc.org, at which numerous links are available. Not unusual for a professional organization site, some links are open to all and others are available only to members. Among links available only to AARC members is a Chat Room, where AARC members can “talk” with fellow members. One of the more useful links in the AARC Web site is the Buyer’s Guide, which provides links to the Web sites of most manufacturers of respiratory care equipment. Other useful
Comparison of five bilevel pressure ventilators in patients with chronic ventilatory failure: a physiologic study.

Vitaccia M, Barbano L, DiAnna S, Porta R, Bianchi L, Ambrosio N.

Pulmonary Division, Scientific Institute, Fondazione Salvatore Maugeri IRCCS, I-25064 Gossago (BS), Italy.

OBJECTIVE: To compare patient-ventilator interaction and comfort in patients with chronic ventilatory failure (CVF) who are undergoing new-generation positive-pressure ventilation with five different commercial bilevel pressure control ventilators. Also, we wanted to evaluate the short-term effects of the five ventilators on physiologic variables, namely, breathing patterns and respiratory muscle. DESIGN: Randomized, controlled physiologic study. SETTING: Pulmonary division of a rehabilitation institution. PATIENTS: Twenty-eight patients with CVF due to COPD (17 patients) and restrictive chest wall diseases (11 patients). MEASUREMENTS: Simultaneous recordings of airflow, transcutaneous and end-tidal CO2, respiratory muscle and mechanical, and patient-ventilator interaction during both unassisted and assisted ventilation with the five ventilators applied randomly. RESULTS: The five ventilators showed different flow and pressure waveforms. The level of comfort was somewhat different among the studied ventilators. When compared to unassisted ventilation, all ventilators induced a significant increase in E (p < 0.01) without any significant difference among ventilators. Use of the five ventilators resulted in significant differences in peak airway opening pressure (Ppeak) but not in mean airway opening pressure computed over a period of 1 min (PTPmean), and in a shorter cycle. Ineffective-efforts (Ei) were similar among the studied ventilators. In comparison with unassisted ventilation, all ventilators induced significant reductions in inspiratory muscle effort (p < 0.01). No significant relationship was found between level of comfort and PTPmean, Ppeak, or the number of Ei. CONCLUSION: In stable, awake patients with CVF, all of the studied ventilators were well-tolerated, although a great inter-subject variability in comfort was performed well in terms of improvement in Ei and inspiratory muscle unloading, thus fulfilling the aim of mechanical ventilation. This effect was obtained with similar levels of PTPmean, despite the fact that Ppeak was different among some ventilators. The number of Ei was similar among the studied ventilators.

Fig. 2. (Continued). Top: Display abstracts of interest. Note full-text link. Bottom: Display Related Articles. Note the icon next to reference 3 that denotes availability of the full-text report.
racic Society (http://www.thoracic.org), and the Society for Critical Care Medicine (http://www.sccm.org). These sites typically provide links to profession-related information, the journals and newsletters published by the professional organization, clinical practice guidelines (CPGs), and educational material for clinicians and patients.

Respiratory-Care-Related Web Sites

There are several Web sites devoted specifically to issues of interest to the practice of respiratory care. One of these is the RCSourcePages Web site (http://www.sourcpages.com), the most useful aspect of which is the extensive number of links available. Another useful site is VentWorld (http://www.ventworld.com), a source of ventilator product and supplier information, news, discussion, education, tools, and mechanical ventilation resources for the respiratory and critical care community. This site also provides a large number of useful links.

Clinical Practice Guidelines

Clinicians need concise, peer-reviewed, up-to-date information to make clinical decisions. Increasingly, this information is in the form of CPGs. CPGs for asthma management can be found at http://www.nhlbi.nih.gov/about/naepp, and CPGs for the management of chronic obstructive pulmonary disease can be found at http://www.goldcopd.com. Many professional organizations have published CPGs. CPGs published by the AARC can be found at http://www.rcjournal.com/online_resources/cpgs/cpg_index.asp.

The National Guideline Clearinghouse (http://www.guideline.gov) is a comprehensive database of evidence-based CPGs and related documents produced by the United States Department of Health and Human Services Agency for Healthcare Research and Quality, in partnership with the American Medical Association and the American Association of Health Plans. The National Guideline Clearinghouse mission is to provide an accessible mechanism for obtaining objective, detailed information on CPGs and to further their dissemination, implementation, and use. Key components of the National Guideline Clearinghouse include structured abstracts about the CPGs and their development, links to full-text CPGs and/or ordering information for print copies, a guideline-comparison utility that generates side-by-side comparisons for any combination of two or more CPGs, CPG comparisons prepared by National Guideline Clearinghouse staff, an electronic forum for exchanging information on CPGs, and an annotated bibliography in which users can search for publications and resources about CPGs, including CPG development, methodology, structure, evaluation, and implementation.

The Cochrane Library (http://www.cochrane.org) is a collection of evidence-based medicine databases, which includes the Cochrane Database of Systematic Reviews. These provide highly regarded, high-quality information. Abstracts are available free of charge. Full-text access to Cochrane reviews is available through search engines such as Ovid. There are currently over 1,700 Cochrane reviews, and many relate directly to respiratory care practice.

E-mail

E-mail correspondence can be a useful method of gaining information from a trusted colleague or a noted expert. E-mail addresses are relatively easy to find. For example, the e-mail address of a report’s corresponding author is typically published in the report’s author-information footnote. Frequently, e-mail addresses are listed on the Web site of the institution where the individual is employed. E-mailing an expert can be a valuable method to obtain high-level information. However, e-mailing an expert should be reserved for the most difficult issues, as these individuals are unlikely to respond to trivial matters that are not intellectually intriguing. E-mail is a one-on-one communication. E-mail lists can be used to communicate with a group of people. E-mail lists allow communication with everyone in a clinical department, the members of a committee, or the members of a professional organization.

Listserv

A Listserv is an e-mail list management program. The Listserv software is installed on a server with a dedicated connection to the Internet. An e-mail address is created for the Listserv, which is used to send (“post”) messages to subscribers. When a message is sent to the Listserv from a subscriber, the Listserv automatically distributes the message to all subscribers on the list. There is a catalog of Listserv lists at http://www.lsoft.com/lists/listref.html. Subscribing to a Listserv involves either (1) e-mailing the Listserv address a message with the word “subscribe” in the subject line or (2) visiting the Web site associated with the Listserv and signing up at that Web site. Some lists of particular interest to respiratory therapists include RC_WORLD for general respiratory care (listserv@indycms.iupui.edu), CCM-L for adult critical care (majordomo@list.pitt.edu), PICU for pediatric intensive care (listproc@listproc.mcw.edu), PED-LUNG for pediatric pulmonology (majordomo@unixg.ubc.ca), ECLS-NET for extracorporeal life support (listproc@u.washington.edu), iNO-I for inhaled nitric oxide (majordomo@lists.invivo.net), and NICU-NET for neonatology (listproc@u.washington.edu).

The information available on a Listserv is best characterized as opinion and anecdote. The responses to a question posed on a Listserv may provide some insight into common
practice, but may provide no information about best practice. That is not to say that the information obtained from a Listserv cannot be helpful, but it does mean that the consumer of the information must recognize that the advice offered is not peer-reviewed or validated, and might be wrong.

Industry Web Sites

Almost every manufacturer of respiratory care equipment has a Web site. Although the intent of these sites is clearly commercial, they nonetheless may offer useful clinical information. There may be considerable information about equipment and instruction for its use. In some cases, operation manuals are available in their entirety. There may also be tutorials related to the use of equipment. In some cases there is extensive reference material, including links to the peer-reviewed literature.

A Real-World Example

Imagine that you are asked to provide noninvasive ventilation for a patient with amyotrophic lateral sclerosis (ALS). Although you are skilled with the practice of noninvasive ventilation, you are not very familiar with the care of ALS patients. Moreover, you are not familiar with the current evidence for the use of noninvasive ventilation with ALS patients. So you log onto the Internet to find (1) general information about ALS and (2) the role of noninvasive ventilation in the care of ALS patients.

To find general information about ALS, search via Google using the key words “amyotrophic lateral sclerosis.” This retrieves a link to the Amyotrophic Lateral Sclerosis Fact Sheet (http://www.ninds.nih.gov/health_and_medical/pubs/als.htm), which provides useful general information about ALS. Next, search PubMed for the phrase “amyotrophic lateral sclerosis,” with search limits set to Review, English, and Human. Unfortunately, the first 20 citations do not appear useful and you decide to search elsewhere. In Ovid you choose the database Books@Ovid. You choose Harrison’s Principles of Internal Medicine and again search with the phrase “amyotrophic lateral sclerosis.” This provides a comprehensive chapter entitled “Amyotrophic Lateral Sclerosis and Other Motor Neuron Diseases.”

Having learned something about ALS, you now want to find more information, specifically about the use of noninvasive ventilation in the care of ALS patients. A PubMed search is conducted using the search term “noninvasive positive-pressure ventilation AND amyotrophic lateral sclerosis.” This yields over 20 citations on the subject. A search in the National Guidelines Clearinghouse using “noninvasive positive-pressure ventilation AND amyotrophic lateral sclerosis” produces no results, but limiting the search to “noninvasive ventilation” produces a link to the CPG. “Practice parameter: the care of the patient with amyotrophic lateral sclerosis (an evidence-based review). Report of the Quality Standards Subcommittee of the American Academy of Neurology: ALS Practice Parameters Task Force.” This guideline provides recommendations related to the use of noninvasive ventilation with ALS patients. An abstract of the CPG is published in the Clearinghouse and a link is provided to the full-text version, published in the journal Neurology.

After a 30-min search and an hour reviewing the information that is found, you are ready to introduce the patient and his family to the use of nocturnal noninvasive ventilation. You initiate the therapy using a portable pressure ventilator and nasal mask. Two weeks later you are contacted by the patient’s spouse, who has learned about nasal pillows at an ALS support group. You are asked for information about that interface, as the patient is uncomfortable with the nasal mask and is developing skin breakdown over the bridge of the nose. You are also told that the nasal pillows are available from Puritan Bennett. You go to the AARC Web site, click on “Buyer’s Guide,” and enter “Nellcor Puritan Bennett” in the search box and follow the link to http://www.puritanbennett.com. In the respiratory home care section you find information about nasal pillows with Breeze headgear—the specific interface that the patient requested.

Summary

A considerable amount of information can be accessed quickly and inexpensively, using nothing more than a computer and an Internet connection. This demands skills in searching and accessing that information. This information exists at very high levels, such as PubMed, the National Guideline Clearinghouse, and the Cochrane Library. However, there is also much information available on the Internet that has not been validated or subjected to peer-review. Thus it is important not only to find information but also to separate useful from useless information.

REFERENCES


Discussion

Gardner: Tell us more about patients, families, and others getting access to information. My son is a biker and Lance Armstrong is, of course, the hero of the family. I heard about how much Lance dug for and got good cancer information during his bout with cancer. But I also hear things from people who go to Web sites that give awful, incorrect information, and they come to me and just drive me nuts with that misinformation. How big of a problem is that?

Hess: That has not been well studied. My sense is that it’s a problem and it’s getting bigger, but the literature hasn’t really reported cases of patients who have done harm to themselves because they didn’t listen to their doctor and they got all their information from a Web site. I suspect we may be hearing more about that in the future. I think for us as clinicians it’s important to recognize that our sophisticated patients are looking on the Internet for information. And it’s not so unusual for me to learn about things first from a patient who tells me that he either saw something on the news last night or came across it on an Internet search. Consider the example of the patient who found out about a device from another patient; he could’ve found out about it by doing his own Internet search.

It can be intimidating for us as clinicians when we feel as though our patients know all this stuff that we don’t know, that we haven’t scrutinized, and we don’t know if it’s valid. I’ve already told patients, for example, to tell me where you got that information, and then I will go and look at that information and together we can discuss it, after which we can arrive together at whether it is something the patient should be paying attention to.

Pierson:* I’d like to continue along that line, and I think it’s really important that you pointed out to us the caveat emptor aspect of what we get on the Internet. This extends not only to our patients finding information but also into the realm of CME [continuing medical education]. I am impressed by the volume of CME that comes my way as a physician, both electronically and in my mailbox, free!

Hess: You get what you pay for.

Pierson: You’re exactly right. I suppose it’s possible that someone with great expertise might out of pure altruism decide to share that with the world. That’s an expensive proposition, however, and the reality is that virtually all this “free” CME is sponsored. But sometimes you have to dig pretty deep to find the sponsorship.

I recently had a pharmaceutical representative in my office who was touting a new drug and encouraging me to use it. Realizing I’m an ivory tower egghead type, he said, “I realize you don’t want to just look at our advertising material, so there is this Web site where you can get unbiased information that has no connection to our company.” He gave me the Web site address, and after he left I went there and dug around the Web site and, sure enough, it was supported by an unrestricted educational grant—in fact, operated by that company.

I think it’s great that we’re all using the Internet for more of our information, and it’s helping in a lot of ways. However, I am really glad you emphasized the importance of looking very critically at who’s giving you the information and where it’s coming from, because, as you pointed out, there really is no free lunch.

Hopper: In that same vein, we should keep in mind that most of the search engines are not free of commercial bias. We’d like to think that results turn up in order of the number

of hits they have received or according to the date, when in fact many are commercial at the top of the list. Also, keep in mind that with even the best ones you like to think that it’s information that’s up to the minute, but the database that it’s referring to may be weeks or months old. As evidenced by the fact that even on Google some of the top hits have broken links. Just because Google’s search response is rapid doesn’t mean that the information you retrieved is up-to-the-minute. And they’re not always identified as ads. Some of the search engines are more honest than others and you can kind of pick them out.

The AARC put the CPGs on the Web a long time ago, and I thought it was a great idea; I still do, and we are well ahead of some of the other fields in doing that. But I sometimes have this nightmarish vision of a patient with a wireless Internet connection who’s receiving therapy and ticking off how the practitioner’s doing with a checklist and then copying and pasting that into an e-mail message to an attorney. Have you heard of that sort of thing getting us into trouble?

**Hess:** I have not, although it brings up a concern that I have about some of this information that patients have Internet access to. This gets back to Reed Gardner’s comment that some patients tend to take information out of context.

I have an anecdote that relates to this problem. One of our pulmonary physicians a few months ago paged me and asked some questions about one of the AARC CPGs on mechanical ventilation in the home. One of his patients had questions about things related to that CPG. As it turned out, the CPG was being used out of context. The patient picked a few things from the CPG and sort of drilled in on those without looking at the bigger picture.

**Giordano:** I just want to offer the aside that the issue of compliance with practice guidelines within the legal context was addressed during a recent Webcast we hosted and that I moderated with Tony DeWitt, who, as you know, is an attorney. It’s, by the way, available as included in the cost of your AARC dues. I guess I shouldn’t say “free” to AARC members because you get what you pay for. But it is archived on our Web site and that very question is addressed. Not to practice law, but I can assure you that, as Tony put it, so long as you are exercising your best clinical judgment, there is no additional—of course you’ve always got the additional cover of being in compliance with generally accepted guidelines—but so long as you are in the position to make that clinical judgment in the best way that you can, you’re not necessarily exposed just on the basis of noncompliance from a malpractice point of view. So I would encourage all of you to dial up our Web-cast central on our Web site. It is available. You can view it while you’re here, as a matter of fact, and see those things.

**Hess:** What’s important is that we have good guidelines. If we have guidelines that we can’t defend, then we can’t defend using those guidelines.

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*Sam P Giordano MBA RRT FAARC. Executive Director, American Association for Respiratory Care, Irving, Texas.*