

Information Literacy for Speech-Language Pathologists: A Key to Evidence-Based Practice

Barbara J. Nail-Chiwetalu
Nan Bernstein Ratner

University of Maryland, College Park



On January 1, 2005, a new set of standards for clinical certification in speech-language pathology took effect. These new standards from the American

Speech-Language-Hearing Association (ASHA) outline an action plan identifying the knowledge and skills needed for clinicians to enter the practice of speech-language pathology. One of the standards, Standard III-F, states that, “the applicant must demonstrate knowledge of processes used in research and the integration of research principles into evidence-based clinical practice” (ASHA, 2004, p. 6).

Evidence-based practice (EBP) has become a critical tenet of speech-language pathology in the new millennium. EBP (Sackett,

Rosenberg, Gray, & Richardson, 1996; Straus & Sackett, 1998) includes the following assumptions: First, that clinical skills grow with the application of currently available data, not simply personal educational and clinical experience. The practice of speech-language pathology is dynamic, and training received in graduate school, as well as clinical experience garnered over time, may not provide clinicians with knowledge of the most efficacious approaches to assessment and treatment of the cases that they will confront in everyday practice over the span of their careers. Second, the expert clinician should consistently seek new information to improve therapeutic effectiveness. To this end, clinicians should be data seekers, data integrators, and critical evaluators of the application of new knowledge to clinical cases.

Information is found by doing research. Research is a *process* that involves a number of steps or stages, some of which may be repeated over the course of seeking information. A person who is information literate is proficient in the research process and is able to satisfy information needs by finding appropriate information. Although numerous models exist for outlining and describing the research process for individuals at varying stages of the educational process (from elementary school through graduate education and throughout one’s career), they all contain some common basic features or skills that must be achieved in order to complete the process. This tutorial will present a framework that must be achieved if speech-language pathologists (SLPs) wish to become and remain information literate.

ABSTRACT: Purpose: In this tutorial, we review the tenets of information literacy (IL) that parallel and intersect with new American Speech-Language-Hearing Association (ASHA) certification standards requiring clinicians to engage in evidence-based practice (EBP).

Method: A review of the literature on EBP in medical and allied health areas was conducted through an online database search. The *Information Literacy Competency Standards for Higher Education* (American Library Association, 2004) are used as a framework for outlining IL practices that will aid in EBP.

Results: Current strategies are contrasted with more desirable strategies. Potential barriers to the utilization of information-literate procedures in locating sources of reliable clinical evidence are discussed together with potential solutions.

Conclusion: Suggestions for more efficient information searches by clinicians, as well as a proposed discipline-wide agenda for increasing clinicians’ IL skills during and after entry-level graduate training, are provided.

KEY WORDS: information literacy, evidence-based practice, certification standards

HOW THE REQUIREMENTS OF EBP INTERFACE WITH INFORMATION LITERACY (IL)

Steps in implementing EBP might include the following for a given clinical problem, as Sackett (2000) noted: First, the clinician must pose a clear and concrete question. This in and of itself is not

as easy as one might suspect. An overly broad question, such as “What is the best treatment for stuttering?” or “How does a child’s language abilities affect their reading skills?” is unlikely to yield information that will answer the question. A narrower question, such as “What efficacy data exist for operant treatment of stuttering in young children?” or “What measures of phonological awareness predict children’s later reading abilities?” is more likely to produce data that are more readily interpreted and usable in clinical practice.

Next, the clinician should search the literature. The term *should* reflects our growing understanding that clinicians in many fields, not just speech-language pathology, may not perform such searches. Rather, they may seek less formal advisement when confronted with clinical problems they wish to understand better. Physicians (Cullen, 2002; McAlister, Graham, Karr, & Laupacis, 1999; Schaafsma, Hulshof, van Dijk, & Verbeek, 2004), physical therapists (Jette et al., 2003), and rehabilitation therapists (Rappolt & Tassone, 2002) have all been reported to place higher value on asking their colleagues for opinions when making clinical decisions than on seeking scholarly sources of information. Recently, Powell and Case-Smith (2003) obtained similar results when they surveyed practicing occupational therapists, who have also adopted EBP guidelines. The vast majority of respondents (79%) indicated that they consulted colleagues or supervisors when seeking clinical guidance. When practitioners consulted other sources, they were most likely to search the open Internet, a concern that we address in detail later. Recently, almost identical profiles of evidence-seeking behavior were observed in a survey of Australian SLPs (Vallino-Napoli & Reilly, 2004). Virtually all of the surveys referenced above found that, across multiple health-care-related disciplines, colleagues are the primary source of information for practicing clinicians, followed by textbooks, continuing education (CE) workshops, and the Internet. None of these, as we elaborate, will be a substitute for locating evidence in the published literature.

It is the process of searching for information, of searching the “literature,” that will be a large focus of our discussion because it is a step that is fraught with complications when it is done incorrectly. Further, there have been substantive and important changes in how professional information is typically gained and disseminated. Using current information technology, how does one search for information appropriately and efficiently? We will explore this question in depth.

The third step of EBP requires the clinician to critically evaluate the information that was obtained. Does it appear to be reliable and valid? This important step presumes that clinicians know how to evaluate published data and determine whether or not they are relevant to their specific question and case. Finally, the fourth step requires the clinician to evaluate the impact of the information on actual practice, making adjustments as needed, and repeating the information-gathering process as necessary.

Parallels Between EBP and IL

We come to the issue of EBP and IL from differing, overlapping, and converging backgrounds in both communication sciences and disorders and library and information science. As colleagues teaching in the same department, it has been striking to observe the strong parallels between the recent emphasis on EBP and the tenets of IL. IL is defined by the American Library Association (ALA) as “a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the

needed information” (1989, p. 1). In higher education, it is expected that students not only become information literate in order to complete courses successfully, but that these skills extend into “internships, first professional positions, and increasing responsibilities in all arenas of life” (ALA, 2004, p. 4). In short, the goal of higher education is to create lifelong learners. In this day and age, characterized by the information explosion and rapid technological advances, the development of skills in finding appropriate information is critical in many areas of life.

In delineating the *Information Literacy Competency Standards for Higher Education*, the ALA (2004) lists five standards,¹ which we will explore individually for their application to EBP in communication disorders. Increasingly, strong parallels are being drawn between such standards and the successful implementation of EBP in a variety of disciplines (Kaplan & Whelan, 2002). See Table 1 for an illustration of the overlap between components of these two schemata. Although they do not fully parallel one another, particularly in how they apportion the later stages of the IL and EBP processes, they form a useful template for considering the skills that will be required for EBP in the emerging climate of information overload. In the following section, we review each standard and elaborate on how it is best realized within the context of speech-language pathology.

Standard 1: Determine the Nature and Extent of Information Needed

One cannot go into this stage cold. By this, we mean that whether the question is clinical, academic, or personal, one may need to do some background reading or discussion with others simply to become more familiar with the topic and to be able to formulate an initial question. This question almost always will require refinement or revision after the initial exploratory search is performed. The initial stage is the point at which a very global search for resources (e.g., using diagnostic terms such as *apraxia* or *stuttering*) is likely to produce a large array of current information from which the clinician can then narrow his or her focus. We also note that increasingly, our clients may directly provoke our need to search for information by asking us focused questions about treatments they have researched themselves on the open Internet (Cullen, 2002), or on television, as in recent coverage of the SpeechEasy device for the treatment of stuttering.

Standard 2: Access Needed Information Effectively and Efficiently

Surprisingly in today’s world, this step may be the most difficult to execute properly given the varied sources of information and abundance of it as well as quicker, self-service access through the Internet. It also appears to be the stage that is ignored most often in recent discussion of the implementation of EBP in our discipline (Ingham, 2003; Meline & Paradiso, 2003; Pietranton, 2006). In such discussions, it is assumed that clinicians understand how to obtain evidence—an assumption that is very much in question following studies of practitioner behavior in related disciplines. At this stage, it is critical that the clinician select the *most appropriate investigative methods or information retrieval systems* for accessing information. Put succinctly, this really translates into knowing one’s

¹In this document, we replace the original term “student” with “clinician” to emphasize the clinical relevance of these standards to speech-language pathologists.

Table 1. Comparison of the Association of College and Research Libraries' information literacy competencies and steps in evidence-based medicine.

<i>Association of College and Research Libraries competencies</i>	<i>Steps in evidence-based medicine (adapted from Sackett, 2000)</i>
Determine the nature and extent of the information that is needed.	Convert the need for information (about prevention, diagnosis, prognosis, therapy, etc.) into an answerable question.
Access needed information effectively and efficiently.	Track down the best evidence with which to answer the question (select the best evidence resource and research it efficiently and effectively).
Evaluate the information and its sources critically and incorporate selected information into one's personal knowledge base and value system.	Critically appraise the evidence for its validity (closeness to the truth), impact (size of the effect), and applicability (usefulness in clinical practice).
Use information effectively to accomplish a purpose.	Integrate the critical appraisal with clinical expertise and with the patient's unique biology, values, and circumstances.
Understand many of the economic, legal, and social issues surrounding the use of information and access and use the information ethically and legally.	Evaluate the effectiveness and efficiency in executing the four above steps and seek ways to improve them for the next occasion.

search engines, interfaces (the database screens), and content available through a given system, as we will detail. This is the link that is apparently quite weak according to research on the clinical implementation of IL.

Know How to Read the Signs on the “Information Superhighway”

Most of us are highly familiar with a variety of search engines, such as Google, Yahoo, and Alta Vista. They have become virtually essential, ubiquitous tools of everyday life, helping us in such important daily activities as locating products, services, and people and seeking professional and personal guidance. Because such utilities have assumed such an integral function in our society, it is sometimes difficult to evaluate exactly what types of information are likely to be found using such engines to explore the open Internet (in the popular parlance, “Googling” a question), and the scope continues to evolve over time. Our experience and a review of the professional literature tells us that even college professors are sometimes confused by the products of Internet searches, yet they prefer them over proprietary search engines and database vendors hosted by their universities or medical centers or obtained by individual subscription. In responding to an article that discussed the changing roles of today's university research librarians in assisting faculty and students to develop IL skills, one faculty member responded,

If “Google has won”...it deserves the victory.... I don't know anyone who wouldn't prefer sorting through too much material to scouring library shelves or limited databases to find enough.... If a Google search can accomplish that more effectively, I say hurray for Google...it eliminates the middleman between user and information—how wonderful! There are still many niches for librarians to fill. (Burkhardt, 2003, p. B18)

Such a comment reflects a serious misunderstanding of the fact that information on the Internet differs critically in numerous ways from information that is available through proprietary or professionally sponsored search engines or from database vendors. Cullen (2002) found that practicing physicians could not discriminate between professional database resources and Internet search engines, listing such resources as Yahoo, Alta Vista, and Google as major avenues for the acquisition of professional information. These utilities search the entire open Internet, a

landscape that is fraught with the potential for misinformation or misuse of information. Silberg, Lundberg, and Musacchio (1997) cautioned that the Internet “is a medium in which anyone with a computer can serve simultaneously as an author, editor and publisher, and fill any of these roles anonymously if he or she so chooses. In such an environment, novices and savvy Internet users alike can have trouble distinguishing [not only] the wheat from the chaff, [but] the useful from the harmful” (p. 1244). In short, if one goes looking for information in the wrong places, it is likely that the information obtained will have little value. Despite this concern, it has been well documented that professionals in many health professions turn to Internet search engines to answer clinical questions (Cullen, 2002). Thus, in the next sections, we describe and contrast the types of information one obtains from various Internet-based sources and their unique values and limitations.

Get to the information and get there safely. First, the open Internet is just that—open and unregulated. There is virtually no oversight over information that is posted to the Internet by individuals. Thus, an important first step in IL is to be able to navigate the Web intelligently. Although navigation implies choosing a route, we will first discuss destinations: how to know if you have reached information that is credible and reliable.

Before we detail what is likely to emerge from an Internet search, however, we would like to note what is *not* likely to show up on a Google-type search of most clinically relevant questions: *peer-reviewed research*, the core information used in establishing sound evidence-based diagnostic and therapeutic recommendations. Such research, primarily contained in our professional journals and texts, is held under copyright and is rarely available for free download in Internet searches.² Rather, although information about such resources (telling you that an article exists in a given journal) may be revealed using free access sites designed to search the professional literature (such as PubMed, which we will discuss further), the majority of information that is yielded from most searches will, at best, reference secondary or tertiary summaries of published information. At worst, posted information may not be based on any peer-reviewed research on the topic at all.

²It is much easier to download illegal copies of copyrighted songs and movies than to locate full-text articles of professional articles or chapters unless the user has access through an appropriate portal, as we describe later in this article.

How to evaluate a web site. As we noted, often a very good search of a clinical question can start with a broad query, even one on the open Internet. It can then be used to search the professional literature more deeply and effectively. But, how is the user to know what value to assign to the information that scrolls down the screen? Many colleges and universities have guidelines to Web site evaluation posted on their Web sites. One example may be found at the University of Maryland, College Park, at <http://www.lib.umd.edu/UES/evaluate.html>. Some of the standard questions any Internet searcher should ask are provided in the next several paragraphs.

Who authored the site? This is a larger question than locating an individual's name and qualifications. Authorship is also revealed by domain name, which can be an individual who has purchased or is entitled to use a computer network's Web space (typically anything ending in *.net*), a commercial company (*.com* or the newer *.biz*), an academic institution (*.edu*), a government agency (*.gov*), a nonprofit organization (*.org*), or a person or group outside the United States (as in *.ca* for Canada, *.uk* for United Kingdom, or *.au* for Australia). Information offered by many vendors of services or products (almost always *.com* sites) does not clearly identify potential bias in posting information about disorders and their recommended treatment, as one might expect. A nonprofit organization may or may not possess and post information that would reflect current professional guidance in a problem area. Less obvious a problem still is the pandemic use of educational (*.edu*) sites to post student projects and papers, which may in turn be interpreted by Internet searchers as validated and reliable information, which is not necessarily so. (Many educational institutions also have very loose oversight of Web sites generated by employees and students, which can then be used to post personal or group viewpoints that are not necessarily commensurate with the evidence on a particular treatment approach, as we will show in a moment). Even government and organizational sites that post information that is likely to be endorsed by experts in a problem area are most likely to post secondary or tertiary summaries of studies on a clinical topic and thus will not be amenable either to in-depth scrutiny, or, in the case of implementation of a diagnostic or therapeutic technique, information specific enough to aid the clinician in replicating the procedure or intervention.³

What is the purpose of the site and the nature of its general contents? The answer to this question is not always apparent and may require the user to click through various options and links. A user can ask: Does the site seem to be designed to provide research and scholarly information? Does it offer educational or consumer information and/or support? Does it appear to advertise, endorse, market, or sell something? Does it appear to take a particular advocacy position (as in endorsing one approach to the treatment of a disorder as opposed to others)? This type of site is likely to use persuasive argumentation to sway the reader to a particular position. Although most Web site evaluation guides urge readers to evaluate whether a site is complete, balanced, or biased, frankly, we believe that this is often difficult to achieve in the absence of comparing the site to other information gleaned from open Internet and professional resource searches. In some cases, information that looks valuable at first impression may become less so after a more thorough series of searches has been made. As a ready example, a search of the term

facilitated communication brings up a university-based facilitated communication institute and a university-hosted facilitated communication network, with information, training, and support links for the intervention, both within the top five search results. Despite the fact that both ASHA (1994) and the American Psychological Association (APA, 1994) have posted position statements finding the intervention to be without scientific merit, the majority of "hits" on the first page are hosted by groups and organizations that seek to promote its use, and in fact post published literature that has supported its effectiveness, creating an impression of scientifically based authority. Only the Web searcher who locates the ASHA and APA position statements, which reference a larger body of literature, or who performs a scholarly search of the topic area, will be able to appreciate the potential bias on some of the sites that are returned by the Internet search.⁴

Currency of the information. Can the user determine the last time the Web site was modified or updated? Web sites seem to be easier to construct than to maintain or even remove once their purpose has been accomplished. Web pages may be updated to more improved organization or with use of Java script, only to leave the old Web page on the server. (The Internet is full of outdated university class materials, for instance). When such updates are not apparent, the presence of broken or outdated links from the page may legitimately raise suspicion that the information is not recent. EBP requires us to keep pace with *current* development. Internet search engines return results in terms of the number of times users have visited a site, rather than its currency. In contrast, as we will discuss below, database vendors return scholarly reports in order of publication date, with most recent first, unless other sorting options are selected.

To facilitate clinicians' appraisal of Internet Web sites, a sample checklist is available at our home institution at <http://www.lib.umd.edu/UES/webcheck.html>.

There is some good stuff out there. We wish to emphasize that some good information *can* be obtained through open Internet searches. First, keywords and concepts that signal current clinical options are likely to emerge from a general search engine query (especially those that one's clients may have already researched). For example, clinicians who proceed directly to PubMed (www.ncbi.nlm.nih.gov/entrez/query.fcgi), the free database sponsored by the National Library of Medicine (NLM), will be able to search more than 12 million records of scholarly biomedical journals and obtain citations and abstracts for published articles in peer-reviewed journals that are identified as relevant to the search terms that were entered into the system. However, once located, full text of the articles (rather than just the short abstract) must be obtained either in local libraries where available (which may either permit authorized users to download an electronic copy of the article from the home or office or may require users to view the paper copy of the article on-site), by downloading at cost from the journal publisher via the PubMed site, or by visiting a college or university library that subscribes to the journal and allows public access. In recent years, most university libraries and medical centers, as well as some public library and public school systems, have invested in fee-based database collections through vendors such as EBSCOhost and Ovid, which permit the searching of multiple databases relevant to our discipline,

³It is still too early to evaluate the role and impact of institutional repositories, an emerging initiative to place original scholarly content by university faculty members on the Web (such as MIT's DSpace). It is also not yet clear that such sites will be accessible to all Web users.

⁴Users should also be cautious in using Web-based "encyclopedias." Some, such as Wikipedia, are essentially authored by the Web users themselves (like a "blog"—a Web-based personal or group journal), with some, but not failproof, oversight by the Web site's volunteer staff (Stone, 2004).

such as ERIC, CINAHL, Health Source: Nursing/Academic Edition, Language and Language Behavior Abstracts (LLBA), MEDLINE, and PsycINFO. Not only do these databases index scholarly journals (and in some cases, books and book chapters as well), as well as a broad array of other materials, but many now offer full-text access to the article contents that are embedded within the database via a full-text link. Costs for these searches are borne by the institution rather than the individual user per article, which is a valuable benefit.

An emerging resource that has captured popular attention is the evolving Google Scholar (www.scholar.google.com), which attempts to filter searches to those hits that are university based, journal based, and otherwise scholarly. Although this initiative is quite admirable, beta testing of the utility suggests that it will not provide an immediate answer to the concerns that we have noted. For example, we have attempted to search a broad range of clinically relevant topics using the beta version. By far, the most commonly returned hit is of a relatively old (~10 years) journal article or book citation. Although the presence of a wide array of full-text articles was interesting, it would not constitute a good basis for currency in clinical practice. Additionally, there have been concerns about Google's definition of "scholarly" in filtering results. A recent evaluation by Wleklinski (2005) suggested that, at best, Google Scholar will lead users to some references that will then need to be obtained through library or other subscription, but will not replace the more conventional and powerful library databases. Regardless of how the site evolves, users should take care to examine the nature and currency of the information that the search produces.

Access options for unaffiliated clinicians. The primary full-text option for SLPs is hosted by ASHA itself. Any ASHA or student member now has access to all current ASHA journals (i.e., *Journal of Speech-Language-Hearing Research*; *American Journal of Speech-Language Pathology*; *Language, Speech, and Hearing Services in Schools*; *American Journal of Audiology*; and *Contemporary Issues in Communication Science and Disorders*) as well as ASHA position papers online (see www.asha.org). In addition to current issues, holdings go back to 1990, which is sufficient for most searches on relevant clinical concepts. (A recently implemented utility also allows clinicians to enroll to receive free automatic notification of the contents of each ASHA journal issue as it is released.) Clinicians can also follow leads from PubMed searches to ASHA full-text access at the ASHA Web site. Despite this unparalleled opportunity for clinicians to keep up with current research in the field, there are a few obvious shortcomings that we have witnessed. First, many practicing clinicians we have encountered do not seem to know that this option is available to them. Second, not all relevant research in our discipline appears in these journals. Finally, there appears to be a tendency for professionals not to consult the professional literature in solving clinical dilemmas (Cullen, 2002; Rappolt & Tassone, 2002). For example, Powell and Case-Smith (2003) found that occupational therapists were much more likely to turn to the open Internet (69% of respondents) than to consult journal literature for answers to clinical questions. In contrast, only 26% reported using Medline or CINAHL a minimum of once since graduation, despite curriculum-based library instruction. In undergraduate education, which presages the habits of practicing professionals, P. Davis (2003) noted that, between the years 1996 and 2000, student term paper bibliographies grew incrementally but contained progressively fewer scholarly resources—the remainder were obtained through general Internet searches.

For those clinicians who are not affiliated with universities, medical centers, schools, or library systems that offer proprietary database services and who wish to maintain discipline-wide search capacity that goes beyond PubMed, the ComDisDome (www.comdisdome.com) offers individual subscription, fee-based database access to a full range of peer-reviewed articles in communication sciences and disorders, as well as books and chapters that are relevant to the input query. As we proceed to the next section of this tutorial, we address concerns relevant to running efficient and effective searches within such professional databases. We conclude this section by noting that, if our field values its research base and urges its practitioners to adopt EBP, we need to understand that the scholarly literature is not well represented in the open Internet and must be acquired using somewhat more complex methods. The use of Internet search engines to ask professional and/or academic questions may be one reason why, despite the fact that almost any Internet search produces hits, students and clinicians may report that "they can't find any information" about topics of interest to them (Jensen, 2004).

How to be a practitioner who gathers evidence: Some examples. After making a conscious decision to search using particular engines or vendors, clinicians need to appreciate what search language or parameters will be required in the search command. Although it may seem simple to put in a term such as *dysphagia*, a default search in a general/multidisciplinary database such as Academic Search Premier (via EBSCOhost) will produce nearly 1,000 hits, and a more complete search including the databases MEDLINE, PsycINFO, and ERIC will yield an astounding 11,000 results. Clinicians cannot and should not have to weed through such a massive result. The search needs to be narrowed to create a more specific search by using appropriate search techniques such as Boolean connectors (i.e., AND, OR, and NOT, and use of parentheses), limits (e.g., language, date range, and publication type), and search tips (e.g., truncation, wildcard, and nesting). Limits and other search techniques may vary from one database to another. (Specifics on techniques that may be used with a given database typically are available in the "help" section, often found via a link in the upper right corner of the main database screen.) To implement and construct an efficient search strategy, a first step is to identify keywords, synonyms, and related terms appropriate to the research question.

A guide to search terms and strategies. A search that is performed on the open Internet using the term *swallow* or *swallowing* will yield far too many irrelevant results (and perhaps some disturbing ones, depending on the user's filter system) than will a search that is performed using the term *dysphagia*. In any context, clinicians may be surprised to find that well-known terms and acronyms in our field have other meanings in other disciplines. (Try searching SLI, AAC, stuttering, or facilitated communication in PubMed, as examples.) Thus, it is usually advantageous to either spell out the acronym (e.g., *specific language impairment* instead of *SLI*) or pair the term with a discipline-specific term (such as *SLI AND child**, *AAC AND augment**, *facilitated communication AND autism**, *stutter* AND speech*) so as to increase the likelihood that relevant records will be returned. At times, it is helpful to try alternate wording for the search to evaluate the various results based on terms used in a particular database. Similarly, a more complete search will result from the use of truncation, that is, use of a character such as *, which searches for variations at the end of the root term (e.g., *child** will retrieve *child*, *children*, and *childhood*, and *stutter** will retrieve variations such as *stutter*, *stutters*, *stuttering*, and *stuttered*). Furthermore, it would be useful to search variations in spellings such as *dysfluency* and

disfluency as *dysfluen** OR *disfluen** or by using a wildcard, which in some databases would be a *?*, such as *d?sfluen**. So, a specific search in this domain would therefore be *stutter** OR *d?sfluen**.⁵

As clinicians find citations and abstracts to articles in one or more databases that appear relevant to the research question, they need to evaluate the quantity, quality, relevance, and scope of these resources, as well as gaps within obtained information, and re-search as necessary. As they do this, they should record pertinent citation information for later use in establishing their references (if an academic exercise), or in documenting the basis for their clinical approach. This may be done with the use of an online clipboard or folder feature, if it is offered as a feature in the database.⁶ Search findings may then be downloaded to a file, e-mailed back to the user, or printed out as a permanent record of the data-gathering process.

Search engines such as Google and databases from vendors produce different responses to identical queries. Let us undertake three illustrative examples: one of a professor seeking to determine whether or not problem-based learning is an effective approach to teaching, one in which a clinician attempts to answer a parent's question concerning the use of auditory feedback alteration as an effective treatment for her child's stuttering, and one that asks about the therapeutic use of augmentative and alternative communication (AAC) with people with autism.

In the first example, a professor wishes to know whether or not to adopt problem-based learning because it has been touted in recent discussions of improved pedagogy. First, we go to Google, on the open Web. Our results are astounding—*more than 16,000* hits! Most are of relatively high quality, produced by educational institutions. However, the content is wrong for our question: The sites mainly endorse the approach and explain how to implement it; they do not offer information about whether or not it has been shown to be an effective alternative to current pedagogy.

In our next attempt, we go to PubMed, the free database of scholarly biomedical articles indexed by the NLM of the National Institutes of Health (NIH). We rerun the search on *problem-based learning*. This search yields fewer than 2,000 hits. Many of these are, in fact, geared toward evaluation of the effectiveness of the approach, but it becomes clear that most have studied the question in medical professions, such as nursing. So, to explore further, we specify our search as *problem-based learning AND (audiology OR speech)*, using the standard Boolean connectors for constructing searches. To our surprise, we find only seven articles that address application to our discipline, none from the major American journals in speech and hearing. Although it is reasonable to extrapolate from other disciplines to our own, it becomes clear that documenting the appropriateness of this approach to our field is only in its infancy.

In our next search, we simulate the task of a school-based clinician who, given recent media coverage of a technique, has been asked by a student's parent about the advisability of treating her child's stuttering using altered auditory feedback. Once again, we go first to Google and search *stutter** AND *auditory feedback*. Now we get a true mix of results! Of the 2,000 sites that are identified, a large proportion of the top-listed sites (and most of the sponsored links, the Internet equivalent of paid advertising) on the first few pages are commercial ventures selling auditory aids for people who stutter. A few are sites featuring a product (the Speech Easy) that has recently

been publicized on television shows such as *Oprah* and *Today*. A few more are unpublished conference papers; others are chat rooms discussing personal experiences with devices. Taken together, they provide a relatively poor mix of resources for a clinician to determine whether or not auditory aids are appropriate treatment options for people who stutter, or to provide counseling information to the client or his or her family.

Next, we go to the university-sponsored database, Academic Search Premier (via the vendor EBSCOhost), and use its "choose databases" tab option to also include MEDLINE, PsycINFO, ERIC, and other major and relevant health-related databases in its search scope. Using the same search strategy, we retrieve far fewer items, but they do tend to ask whether or not auditory feedback affected stuttering frequency and severity. Unlike the Google search, this search produces a much clearer mix of academic/research sources that differ in their support for such devices. However, even for clinicians or students who are fortunate enough to have full-text support from their institution or vendor, we note the consequences of insisting that *only* those items with full-text be displayed⁷: we got only 12 hits. For clinical instructors in our discipline who wonder why some student papers seem to be clones of one another, the answer may not be plagiarism but simple dependence on the same small set of easily obtainable materials. Other problems that arise from dependency on easily available full-text sources are discussed later in this article.

Our third search looked for information regarding the appropriate use of AAC devices with individuals with autism. We first went to Google and typed in *AAC autism*. We obtained 6,090 hits. On the first page, the hits represented a rather motley group of sites: The top hit was a PowerPoint presentation from a national meeting in the discipline; three in the top 10 were calls for subjects in autism research; two were parent-developed and sponsored Web sites, which had information of mixed quality; one was a personal Web site from a consulting professional in the discipline; and the remaining two were resource sites—one sponsored by the United States Society for Augmentative and Alternative Communication and the other compiled by a well-recognized professional in AAC. There were also a number of sponsored links on the right-hand side of this page. Five offered specific commercially vended treatments for autism (and did not mention AAC); one was a fundraising site for autism research; and one was an extensive bibliography of pamphlets, books, articles, and other materials on autism (but not AAC) that was sponsored by the fee-based information vendor Questia.com. In sum, we found few pertinent resources for answering our clinical query.

We next used the vendor EBSCOhost to search the same question, using the phrase *AAC AND autis**. Here, we received only 55 hits (which we were able to expand to 149 by spelling out augmentative and alternative communication), but almost all of them reported results of AAC interventions with individuals having autism, including some that explicitly evaluated the evidence base for this practice. Unfortunately, only a few reports were in ASHA journals; most were in journals devoted to either autism or AAC that would require the searcher to gain library access in order to pursue the findings beyond the level of the supplied abstract.

Finally, we went to PubMed and entered *AAC AND autism*. Even when we expanded the acronym, we found a disappointing seven hits.

⁵We note that the ComDisDome, the major database available by individual subscription in our discipline, does *not* permit searching with characters (e.g., truncation, wildcards).

⁶Most vendor services and PubMed offer this as a feature.

⁷This is a typical strategy for those who would rather not visit the actual library to do research, or who cannot, such as students finishing a term paper the night before it is due.

Although they were relevant, they represented only a fraction of the published literature on the topic.

In sum, using different search engines/databases and search strategies greatly changes the quantity, but more importantly, the quality and relevance, of the information one obtains. Somewhere between the 7 and 16,000 sources that we discovered in our three simulated assignments, there is room for adequate EBP. We suggest that clinicians treat the open Internet with care, and the full-text ease of university-supported databases with caution as well. The best answer to any question may come from judicious use of both sources of information.

Standard 3: Evaluate Information and Its Sources Critically and Incorporate Selected Information Into Your Knowledge Base and Value System

Just because information is obtained through professional databases does not guarantee its value. Many databases combine texts and book chapters (non peer reviewed) with peer-reviewed, professional, non-peer-reviewed, and popular journals and periodicals. Jensen (2004) noted that today's reliance on the use of computers to access information (as opposed to the "good old days" when one *had* to enter a library), has had interesting ramifications for readers' ability to judge the value of information. She noted that many of the clues that helped readers to judge the nature, intent, and veracity of information (such as physical appearance, advertising, evidence of review boards, footnotes, and annotations) are obscured in many types of digital presentation on computer screens.⁸

The concept of peer review is also very unclear to some clinicians. Peer review implies that literally every sentence in an article has been evaluated by other experts in the area for its content (e.g., an article published in *Language, Speech, and Hearing Services*). Some publications, by contrast, particularly those that are distributed to clinicians at no cost, accept contributions that do not undergo such a demanding review process. (It is important to note that most books, whether designed as texts or not, do *not* undergo a rigorous peer-review process before final text is published. Thus, information in books may or may not provide clinical guidance that can be considered evidence based.) Databases such as PubMed and the ASHA Web site journal search utility retrieve primarily peer-reviewed sources. Many databases include a limit option that allows users to retrieve only those materials that are from scholarly peer-reviewed journals (an extremely wise option to select when searching for clinical evidence). We emphasize again that *most* of what is available through searches of the open Internet is *not* peer reviewed.

The concept of full text also becomes important during the search process. A service such as PubMed will locate a great many articles of relevance to a clinical question in our discipline (although it does not index books or chapters). However, scanning the abstract is not really a substitute for reviewing the full document in determining whether or not the research is valid, reliable, or applicable to the specific clinical case at hand. For example, Cullen (2002) specifically found that physicians were likely to stop at the level of abstracts, even

when they located peer-reviewed studies at reliable sites, such as PubMed. She noted that "abstracts are an unreliable source of information and often overrepresent positive research findings, while oversimplifying negative factors in the findings" (p. 377). Abstracts are almost universally supplied by the author and provide limited information to permit clinical implementation of the concept under discussion. (We note that ASHA journals recently adopted a set of stringent structural requirements for their abstracts, which include listing the article's purpose, method, results, and implications. These requirements should improve the informativeness of the content of articles in ASHA journals.) An effect somewhat related to abstract visibility in promulgating changes in clinical practice has also been noted: Articles that are available in full-text format on the open Internet are more likely to be accessed, read, and cited than those whose full text is limited to subscribers to journals or database services. This bias in spreading some findings further afield than others has been called the FUTON (full text on the Web) bias (Maher, Sherrington, Elkins, Herbert, & Moseley, 2004).

A further issue is replicability. Discussions of the quality of evidence in EBP include many concepts that are beyond the scope of this tutorial (see Robey, 2004). However, a relatively easy concept that can be explored after a literature search is the degree to which a concept has been employed by, and evaluated by, multiple unrelated sites. For example, an apparently promising intervention approach in stuttering, the Lidcombe program (Onslow, Packman, & Menzies, 2001), currently boasts a large empirical body of peer-reviewed research reports, but all have been authored by the program developers.

You mean I have to read all this? The weakness of EBP is that someone must be reading the emerging evidence in order to apply it. This can be a formidable practical challenge for work-weary, multi-tasking professionals. In other fields, such as medicine, there is concern that physicians cannot keep pace with the rate of data publication (Burke, Judelson, Schneider, DeVito, & Latta, 2002; Saint et al., 2000). However, the rate with which evidence appears in the communication disorders literature is more modest, and in fact has been faulted for relatively sparse publication of clinical (as opposed to basic) research studies (Ingham, 2003). Despite this, Vallino-Napoli and Reilly (2004) reported that SLPs in Australia have concerns that are very similar to those of physicians and other health professionals—they report insufficient time to keep up with the professional literature. Time concerns undoubtedly assume even greater dimensions in settings where SLPs have extremely large caseloads, such as schools (Huang, Hopkins, & Nippold, 1997).

The same ASHA standards that mandate EBP also require accumulation of CE credits that are meant to encourage professionals to keep abreast of the current published literature within our discipline. Journal self-study, whether sponsored by individual journals through test materials provided in the issue or accomplished through individually designed or journal club activities, will play a critical role in keeping our profession up-to-date and in compliance with best practices in the assessment and remediation of communication disorders.

During this stage, clinicians would also be expected to *synthesize information and compare it with prior knowledge* about the topic to determine the value added by the new information or identify contradictions and reconcile differences. One way of ensuring that this step occurs is for clinicians to research the conclusion that the others reach in the paper as well as the original topic. In other words, if a

⁸She also noted something else that may be lost forever—the fortuitous discovery of knowledge that occurs when a library user realizes for the first time that the call number of a book can physically direct one to an entire shelf of resources on the same topic. For entire new generations of students progressing to clinical degrees, it is not yet clear what the net gain and loss will be when library visits are supplanted completely by Web-based searches.

clinician reviews a broad literature and concludes that auditory discrimination practice is a worthwhile component in articulation therapy, it is a good idea for the clinician to re-run the search using the terms *auditory discrimination* AND *articulation* to see if he or she has missed anything or if there is a difference of opinion that was not detected earlier.

Standard 4: Individually, or As a Member of a Group, Use Information Effectively to Accomplish a Specific Purpose

This is the heart of EBP. First one gathers the evidence and then applies it to clinical cases. During this stage, clinicians are expected to understand how to translate the evidence into their clinical activities. Interviews with therapists in speech-language and allied health fields suggest that this step may be difficult for many clinicians to bridge; rather, they prefer and rely on the interpretation and instruction of peers and workshop presenters (Rappolt & Tassone, 2002; Vallino-Napoli & Reilly, 2004). The logical desire of most practicing clinicians to see “hands-on” examples of clinical procedures is a pervasive sentiment and serves as a strong disincentive to reliance on the less tangible, more abstract, published literature for changes to or improvement of clinical practices. This bias might be difficult to overcome in the short term and may need to involve deeper instruction of clinicians-in-training on the principles and applications of both EBP and IL. Clinicians must be prepared to extend research reports, which often contain few very specific treatment procedures, to the specifics of their own cases. It is rare for treatment reports to provide step-by-step manualized instruction for use by readers in everyday practice. The clinician must therefore take the initiative to conceptualize the approach and its major components and then customize these principles into his or her practice.

Standard 5: Understand the Economic, Legal, and Social Issues Surrounding Use of Information, and Access and Use Information Ethically and Legally

This requires understanding privacy and security issues, free versus fee-based access, censorship and freedom of speech, and, ever more importantly, intellectual property and copyright/fair use concerns.⁹ For the practicing clinician, a primary concern in implementing EBP will be the costs associated with staying information literate, which will almost certainly exceed a monthly Internet access fee. Once “hooked up,” it is inexpensive to Google the answer to a clinical question but not ethical because of its significant limitations in locating the relevant information. As noted, although the ASHA online journal program makes a substantive contribution to freely available peer-reviewed materials, and should be a first line of defense for clinical information searches, not all relevant research in communication sciences and disorders appears in this set of journals. For this reason, it is wise for practicing clinicians

to evaluate whether or not they have access to databases and full-text journals through a combination of workplace sponsorship (asking whether or not their workplace, local library, or affiliated educational institution purchases database access) and/or individual database subscription (e.g., the ComDisDome). Alternatively, articles of interest may be purchased individually through interfaces on sites such as PubMed.

OBSTACLES TO USING IL TO ACHIEVE FULL IMPLEMENTATION OF EBP

A first obstacle to using IL to achieve full implementation of EBP is the difficulty of firmly establishing the full principles of IL in budding clinicians as they progress through secondary and professional education settings (Jensen, 2004). Jensen noted that IL, as with any other skill, develops based on the user’s successful experience with it. Although there is a growing emphasis on teaching IL skills in high school and college curricula, the majority of suggested assignments that students are urged to undertake are just that—assignments. Research for the purposes of effective clinical practice is inherently different: “discovering the answer to a question the investigator truly desires to know,” such as how to help the client sitting in front of you (Jensen, 2004). Jensen suggested that the premises and stages of IL need to be integrated more into what student clinicians want and need to know rather than what they are simply asked to find and evaluate as a class assignment. Approaches to meaningfully integrating IL into the curricula of programs in general (Jensen, 2004), as well as those in communication sciences and disorders, are discussed in Nail-Chiwetalu and Bernstein Ratner (2003).

As noted, in many fields, a real obstacle to implementation of EBP goes beyond creating IL in health care professionals. We reiterate that in many areas of medicine, the rate of publication greatly exceeds the typical physician’s ability to keep pace with thoughtful reading of emerging information (D. Davis, Ciurea, Flanagan, & Perrier, 2004; Ely et al., 2002). Even in smaller fields, such as occupational therapy, clinicians report that limited access to journals, high costs of access, weak preparation in IL, and a perceived disconnection between basic research and everyday application to clinical problems all serve as significant deterrents to the implementation of EBP (Dysart & Tomlin, 2002; Jette et al., 2003). Studies repeatedly find self-reported insecurity among health professionals in locating and evaluating relevant sources of evidence to defend or adjust their current clinical practices (Jette et al., 2003). To this end, systematic reviews and clearinghouses are emerging as one potential solution (see Kaplan & Whelan, 2002; Pietranton, 2006). For example, the Cochrane Library of Systematic Reviews (available through Web subscription at www.cochrane.org/reviews/clibintro.htm) and the National Guideline Clearinghouse of the Agency for Healthcare Research and Quality (ARHQ; available at www.guideline.gov) have joined a growing number of discipline-specific databases that are designed to summarize and interpret large and growing bodies of data relevant to informed clinical practice.

However, as Pietranton (2006) noted, the quantity and quality of outcome data for many diagnostic and therapeutic techniques and processes in speech-language pathology are not yet as plentiful as they are in medicine or even in related fields such as occupational therapy, physical therapy, or clinical psychology. The relatively small number

⁹It is not the intent of this tutorial to address pedagogical concerns such as curriculum development in IL or academic honesty issues (e.g., plagiarism), which studies have shown are large problems in academic settings. For suggestions on how academic programs and students can address such issues, see Nail-Chiwetalu and Bernstein Ratner (2003).

of studies that can be subjected to meta-analysis may lead to unsatisfying or even misleading conclusions about best approaches to treatment in some areas of practice (Pring, 2004). Currently, our evidence base is comparatively weak when contrasted with the traditional medical literature that spurred the concept of EBP and will need to be augmented by increased research attention to and funding of treatment efficacy studies (Ingham, 2003). The volume of available literature needs to be increased. Users also need to be aware of the fact that meta-analyses typically cannot reflect the specific profiles of individual clients and how well they may or may not match the populations used in the contributing studies.

Finally, there is a culture that encourages health care professionals across a number of our related disciplines to prioritize their colleagues' opinions, texts, and CE workshops over scholarly literature searches or systematic review sites (Cullen, 2002; McAlister et al., 1999; Rappolt & Tassone, 2002). A recent study of Australian SLPs (Vallino-Napoli & Reilly, 2004) revealed much the same pattern. Although the majority of respondents indicated that they understood the concepts and importance of EBP, searches of the scholarly literature were less commonly reported than was relying on peer professional judgment or workshops when seeking information relevant to clinical cases. The Internet was reported to be an information source by almost two thirds of respondents; however, use of open Internet sites and peer-reviewed Web-based sources could not be distinguished in the survey report. Almost 20% of respondents reported that they had never consulted a professional journal when seeking clinical guidance. There is currently no reason to believe that American SLPs behave in a significantly different manner in these dawning days of an emphasis on EBP.¹⁰ Although consulting with one's peers is a reasonable concept in the workplace, it is no better than "authority-based" practice (Onslow, 2003) unless the colleague aids the clinician in locating the relevant primary evidence. Although colleagues' past experiences with particular clinical approaches are informative, "the plural of anecdote is not evidence" (p. 169), as Ratzan (2002) noted. Rappolt and Tassone (2002) found that most rehabilitation therapists accepted their colleagues' information at face value. Further, they found that colleagues' availability or past relationship with the clinician (e.g., classmates), rather than perceived expertise, was ranked as a major factor in selecting a professional with whom to discuss case management.

Other frequently employed options are not preferable. The typical health discipline textbook is not fully peer reviewed, as noted above, and has a relatively long lead time between compilation and release (McAlister et al., 1999). Finally, although studies have shown that clinicians prefer the interactive, applied medium of CE seminars (Rappolt & Tassone, 2002), oversight of such activities across many disciplines, including our own, is quite limited and does not pass judgment on the specific content conveyed by instructors. Rather, general criteria are used to evaluate the topic area and coverage and presumed qualifications of the presenter. Whether or not information conveyed to attendees is evidence based, and on what evidence it is based, is currently beyond the scope of most professional CE approval processes in many health-related fields, including our own. Thus, although it is commendable that ASHA has moved to a CE

requirement for maintaining professional currency, it may be that a higher level of accountability for the content and evidence base of CE-eligible activities should be required. Further, a greater proportion of CE activities should actively demonstrate how the current evidence base is relevant to both general decision making and individual problem solving. Finally, it might not be too extreme to suggest that a proportion of any CE requirement should be met through objective testing of the content of refereed journal articles chosen to suit the SLP's area of interest. Ideally, this would be paired by objective testing of content to ensure accurate comprehension of materials.

CONCLUSION

There is a classic cartoon that depicts a scientist who has covered a large blackboard with formulas and arrows, displaying his work to a colleague. Its final notation is, "then, a miracle happens." Although not wishing to appear facetious, there is a hint of this problem in our field's current publication and certification emphasis on EBP. Acceptance of EBP as a basic premise of all clinical work in communication disorders necessitates that clinicians want to and are able to obtain relevant clinical *evidence*. Once it is obtained, clinicians must be capable of evaluating the evidence for its relevance, reliability, validity, currency, and replicability. Clinicians' skills in these areas are not well understood, nor are the potential barriers to clinicians' implementation of these skills.

This problem is not unique to our field. Rappolt and Tassone (2002) noted that across disciplines, emphasis on the use of research evidence in selecting and implementing clinical practices has attracted a much larger literature than has analyses of clinician information-seeking behaviors and how they intersect with such recommendations. To what extent do clinicians value different types of information, understand how to find it, and evaluate it? What barriers exist to the implementation of EBP in speech-language pathology and how should we best address them?

Although almost everyone would agree that EBP is a good concept (as noted by one of our colleagues, what is its alternative?—*non-evidence-based practice?*), there does appear to be some degree of disconnect between this rapidly emerging and emphasized principle and actual clinical behavior. A recent *Lancet* editorial that examined EBP guidelines ("Educating, With Evidence," 2004) noted that, "in theory, there's no difference between theory and practice, but in practice, there is" (p. 1485). The same editorial noted that published guidelines for the optimal care of a number of medical conditions are not broadly used by practicing physicians. Why might this be? As noted above, potential barriers are clinicians' value systems, their access to evidence, their ability to search sources of evidence effectively, and the costs and time associated with pursuing evidence to adjust clinical practices. McAlister et al. (1999) also noted that calls for EBP across medical and allied health fields are more likely to flow from academics and researchers than from the ranks of practicing clinicians. They suggest that educational efforts to encourage the use of EBP should target the "front-line clinician" (p. 239).

In our work at the university and in the field, we have discovered that some barriers to EBP are easy to remove: educating clinicians about their options in locating evidence, including the extensive ASHA database, and helping them to evaluate the information that they locate. In this sense, a valuable focus of future CE ventures in our

¹⁰We are currently in the process of conducting a survey of American speech-language pathologists' information-seeking profiles; this project is funded by the University of Maryland Libraries, College Park.

field should be providing front-line clinicians with hands-on experience in using the principles of IL to solve their individually relevant clinical questions. As we move forward with EBP, we should not only emphasize the production and dissemination of high-quality evidence of therapeutic effectiveness, but also encourage methods for ensuring that clinicians are motivated to locate it, know how to find it, and understand how to interpret it.

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Contact author: Barbara J. Nail-Chiwetalu, PhD, MLS, 2105 McKeldin Library, University of Maryland, College Park, MD 20742-7011.
E-mail: bnailchi@umd.edu