Physician Information Seeking Behaviors: Are Physicians Successful Searchers?

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Physician Information Seeking Behaviors:
Are Physicians Successful Searchers?

by
Janice Swiatek-Kelley

A dissertation submitted in partial fulfillment of the requirements
for the Degree of Doctor of Philosophy
in
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The Graduate School of Computer and Information Sciences
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2010
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Physician Information-Seeking Behaviors: Are Physicians Successful Searchers?

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Janice Swiatek-Kelley

January 2010

In the recent past, physicians found answers to questions by consulting colleagues, textbooks, and professional journals. Now, the availability of medical information through electronic resources has changed physician information-seeking behaviors. Evidence-based medicine is now the accepted decision-making paradigm, and a physician’s ability to locate best practice guidelines through electronic information resources has become an essential skill. As physicians struggle to stay current in the wake of an ever-growing volume of medical information, several electronic resources claim to provide one-stop access to the most current information with correct and complete answers to problems encountered in the practice of health care. The complexity of medical information, however, prevents one resource from meeting all of a physician’s information needs.

The research described here sought to identify which resources physicians used to find answers for a particular area of inquiry, identify the appropriateness of their resource selection, and compare the choices with their satisfaction with their results. A questionnaire was e-mailed to a randomized group of family practice physicians asking them to indicate which resources they use to answer questions that arise within their professional practice. Physicians were also asked to rate the attributes of these resources. Their responses revealed that physicians do not always select the correct resource and are not necessarily confident even when they do select the correct resource.

Physicians did not demonstrate a global overview of the strengths and weaknesses of information resources, but rather, consistently chose the same resources in approximately the same order regardless of the information they were seeking. The results of this study indicate that physicians do not understand the scope and capabilities of the resources they are using. This research has produced recommended guidelines to provide health information professionals with a course of action to restructure physician training. These guidelines cover such concepts as vetting a resource, selecting the correct resource for a topic of interest, when to partner with an information professional, an overview of the resources their patients may be using, and a synopsis of other features to support information literacy.
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Chapter 1

Introduction

Traditionally, physicians have relied on their professional experience or the experience of colleagues as the foundation for accurate diagnosis, treatment, and prognosis (Friedland, 1998). In addition, physicians peruse journals or listen to journals on audiotape, such as Audio-Digest (Audio-Digest Foundation, 2006) to stay current in their specialty or to learn about new treatments (Oakley, 1966). As electronic media have made information more available, it has become impossible for even the most devout followers of the literature to keep pace with developments in their field. Alper, Hand, Elliott, Kinkade, Hauan, Onion, et al. (2004) estimated that a physician in a primary care specialty would have to review 7,287 articles each month from 343 unique journals to stay current. Alper, Hand et al. calculated that this would require a physician to spend 627.5 hours per month, or about 29 hours per weekday, or 3.6 full-time equivalents of physician effort.

To assist physicians with the identification of the most reliable health information, evidence-based medicine (EBM) was adopted as the new decision-making paradigm (Friedland, 1998). Friedland first identified the decision-making shift, and his work has been cited since then as the established definition of EBM. Friedland established the parameters used to decide whether a resource or research is evidence-based. EBM allows
physicians to rely on systematic, reproducible, and unbiased studies to make a diagnosis and prognosis, or to decide the usefulness and appropriateness of diagnostic tests and choose a treatment regimen (Friedland, 1998).

EBM-like databases have been created that claim to target information relevant to treatment, effectively winnowing data down to an amount sufficient to answer a physician’s immediate information needs (Alper, Stevermer, White, & Ewigman, 2001; Lawson, 1990). Products such as eMedicine (2008) (owned by Medscape/WebMD) and UpToDate (2007) (owned by Elsevier) are produced in-house by expert physicians who write fully referenced topic reviews (Dartmouth Biomedical Libraries, 2006). While these resources offer quality information, they do not meet Friedland’s (1998) rigorous EBM research standards. To add to the confusion, some of these products may also link to government supported EBM sites. The distinction between EBM resources and commercial products is an important one, which many users fail to understand. Some medical libraries list UpToDate and similar electronic medical information products on their Web sites as an EBM resource. A physician would have to read the two lines of text at the top of the page of the Lamar Souter Library to realize UpToDate is listed at the bottom of the list of resources that go from strongest EBM resources to weakest (Lamar Souter Library, University of Massachusetts, 2009). For this reason, all commercial products that are not completely evidence-based are referred to in this dissertation as electronic medical information products (EMIPs).
Statement of the Problem

The problem investigated in this study was whether physicians understand the differences among the vast array of resources presently available to them. Physicians have access to electronic databases, e-books, treatment and clinical guideline packages, drug databases, and image databases, made available to them through medical libraries, their professional organizations, or purchased from vendors marketing directly to individual physicians. Some electronic resources are free for individuals or purchased for as little as a few hundred dollars. An individual physician can subscribe to UpToDate, an electronic compilation of articles, for $495 ($395 for renewal), rather than the tens of thousands of dollars charged to institutions (UpToDate, 2007). Some physicians are unaware that databases contain different categories of information or may not contain the information they seek (Cullen, 2002; Linton, Wilson, Gomes, Abate, & Mintz, 2004; McGowan & Berner, 2004). In some cases, physicians do not understand the difference between a database and a Web search engine (Cullen, 2002).

Studies that investigated programs designed to train physicians to use electronic information resources found that it is difficult for physicians to comprehend the level of complexity and specificity needed to use these resources effectively (Chumley, Dobbie, & Delzell, 2006; Linton et al., 2004; McGowan & Berner, 2004). Training in medical schools is of particular importance as the new generation of physicians may expect that all search engines should be as simple as Google (Carroll, 2004). Chumley et al. reported that although EBM is taught in most medical schools, few students integrate that knowledge into the patient-care environment. Simple questions (e.g., drug questions) could be answered at the point of care using an electronic drug database in a handheld
device; however, questions that take critical appraisal are more time intensive. Chumley et al. found that third-year medical students apply EBM skills to structured cases in the classroom setting but did not do so at the point of care. The authors posited that the limiter to seeking information was time.

Chumley et al. (2006) suggested that training in information management might encourage the integration of information into the clinical setting. After five weeks, however, there was no difference between 26 students taught information management with EBM skills and the 29 students in the control group who were not exposed to information management processes. New approaches may be needed.

McGowan and Berner (2004) explained the necessity of formalized training in medical schools to train students to appraise and use information found on the Web critically and effectively. The authors listed the following necessary skills: (a) evaluating effective search strategies, (b) assessing quality of information resources, (c) selecting the best information resources, and (d) finding and evaluating information, copyright, and ethics in an electronic environment (p. 30). Linton et al. (2004) evaluated a course in EBM taught during the first two years of medical school. Although pre- and post-test evaluations were not significantly different, some results stood out. Knowledge of the importance of guidelines and where to find them improved, but students did not use advanced search techniques. Student feedback indicated a strong preference for general search engines with a single point of entry for any electronic resource, including books, journals, guidelines, news, and patient and drug information.

Capitalizing on the EBM paradigm, Web site developers have created an overabundance of EMIPs. Developers present these information resources as user-
friendly, requiring no training to use (Alper, Stevermer et al., 2001; MDConsult, 2007; UpToDate, 2007). The quantity of Web-based electronic information resources has made it difficult for physicians to understand the features, limitations, and differing content of each new information resource (Cullen, 2002, Linton et al., 2004; McGowan & Berner, 2004). This is of particular significance in the case of medical residents who are in the best position to be taught new resources but tend to gravitate to simple resources such as UpToDate (Peterson, Rowat, Kreiter, & Mandel, 2004).

Once their residency is over, these physicians will need to enter their profession prepared to make intelligent decisions about the appropriate information resources to use on an ongoing basis (McGowan & Berner, 2004). Some physicians may practice privately or be located in rural areas, which lack access to the quality resources offered by hospital medical libraries or academic institutions. They will have to select their own resources (Richwine & McGowan, 2001).

The availability of the Web and its myriad search engines also affects physicians’ perceptions of electronic resources. Their familiarity with Web searching has led some physicians to believe that all search interfaces work in the same manner and all databases contain the same information (Cullen, 2002). As a result, searches for information are badly constructed, or the most relevant database or Web site is not searched (Bennett, Casebeer, Kristofco, & Strasser, 2004). This can lead to conclusions based on incomplete results and can have a negative impact on the quality of health care and research (Bor & Pelton, 2001a; Bor & Pelton, 2001b; Johns Hopkins University, 2001).

The EBM method is valuable in its place, but it is not clear to some medical professionals that EBM cannot answer every question. Some information can only be
retrieved in a MEDLINE search (Boyd, Darer, Boult, Fried, Boult, & Wu, 2005; Diringer, 2003). Diringer identified the intensive care unit as a professional scenario that typically has no EBM guidelines to direct appropriate care and where a deeper search of the literature would be required. The literature offers many articles comparing MEDLINE interfaces to EMIPs. Allison, Kiefe, Weissman, Carter, and Centor (1999) offered comparisons between MEDLINE and non-commercial EBM electronic resources such as the American College of Physicians’ Evidence-Based Medicine (BMJ Publishing Group, 2007) and the Cochrane Library (Cochrane Collaboration, 2007). In addition to the availability of full text, the other attractive feature of these resources is the limited number of entries retrieved by EBM resources as compared to MEDLINE. Allison et al. stated that the smaller number of articles retrieved lent an “air of simplicity” to these resources (p. 282). This feature was attractive to busy physicians, although the restricted nature of these resources also meant that many topics of potential interest to physicians are omitted. This would be true in a search of EMIPs as well.

A serious consequence of the proliferation of EMIPs is that the U.S. National Library of Medicine’s (NLM) MEDLINE—the accepted gold-standard resource of biomedical information—may be relegated to a secondary status (Peterson et al., 2004). Truncated, easier-to-use interfaces are taking its place. UpToDate (2007) is one such product. Written by teams of physicians, this EMIP contains hundreds of consolidated reviews of diagnosis, disease management, and treatment guidelines, but it is not a compilation of EBM reviews. Nevertheless, UpToDate has become ubiquitous in the health care environment. Many studies attest to the popularity of UpToDate among medical residents (DeZee, Durning, & Denton, 2005; Ely, Osheroff, Chambliss, Ebell, &
Rosenbaum, 2005; Peterson et al., 2004; Schilling, Steiner, Lundahl, & Anderson, 2005). That a generation of new physicians prefers to use UpToDate to the exclusion of other resources is alarming. In crises, the responsiveness of publishers of these resources is vital. The Centers for Disease Control (CDC) immediately posted information to its site when the H1N1 virus (swine flu) threat was first announced on April 23, 2009. On April 24, both Medscape/WebMD and MDConsult posted information on the front page of their sites. UpToDate did not post information on swine flu until May 1. Until then, searchers were directed to generic articles on influenza.

Realistically, physicians may not have the additional time and skill needed to search MEDLINE to find the information most important to a particular case (Braun, Wiesman, Van Den Herik, Hasman, & Korsten (2004). Moreover, when a physician searches MEDLINE, the majority of citations retrieved are abstracts of articles. Of the approximately 5,000 journals indexed in MEDLINE, only about 850 titles provide some full-text articles (U.S. National Institutes of Health, National Center for Biotechnology Information, 2007a). Journals can be embargoed (current issues not available until a certain amount of time has passed), limited to just the most current years (typically from 2000 to the present), or limited to only selected articles within a journal.

Searchers affiliated with a hospital that has a medical library can retrieve additional full-text articles through MEDLINE if the library uses NLM’s LinkOut feature through PubMed (U.S. National Institutes of Health, National Center for Biotechnology Information, 2005). LinkOut is an example of a link resolver, which enables linking from a vendor’s database, such as Ovid’s MEDLINE, to the full-text journals held in the
library’s collection. Ovid, EBSCO, and other electronic information vendors, also offers link resolvers.

Once a search is completed, the articles must still be retrieved and reviewed, and conclusions drawn. This service appears to be provided by UpToDate (2007), MDConsult (2007), and others, which helps explain their popularity. Busy physicians are pleased that they need only perform one search to get immediate, full-text information, distilled into clinical answers based on the evidence found in the literature. The information, however, is not always as reliable as physicians believe it to be. Leape, Berwick, and Bates (2002) and Steinberg and Luce (2005) found that, even in rigorous EBM resources, not all EBM protocols are of the same quality. These authors suggest that the strong preference for EMIP products could create a scenario for substandard patient care.

After years of encouraging end-user searching, the NLM began a new initiative in conjunction with the Medical Library Association (MLA) in 2005. These two organizations support the development of librarians into expert searchers who can become part of the health care team. The expert-searcher initiative will support the “knowledge- and evidence-based clinical, scientific and administrative decisions made by all health institutions” (Medical Library Association, 2005, p. 1). If physicians do not believe they need assistance as searchers, however, they will be unlikely to collaborate with expert searchers. If they perceive full-text commercial EMIP resources as complete and reliable, they have no motivation to pursue further information support.

This problem is not unique to the medical profession. Professional organizations have long championed the need for information literacy instruction to academic
institutions and the public in general. In 1989, the American Library Association (ALA) published a report from the organization’s Presidential Committee, identifying the importance of information literacy in society. The Association of College and Research Libraries (ACRL), a division of the ALA, developed information literacy standards for higher education (Association of College and Research Libraries, 2000). In 1999, the U.S. National Research Council (NRC) Committee on Information Technology Literacy identified the primary skills needed for information literacy for the public and developed illustrative projects to encourage implementation of literacy programs. Information literacy has been acknowledged as an essential goal throughout the educational community (Shapiro & Hughes, 1996).

**Goal to be Achieved**

In the past, training focused on MEDLINE and its complexities. The primary trend now is to train physicians to incorporate EBM tools into their practice, but studies report that few physicians have the time to fit information searches into the clinical setting (Alper, Stevermer et al., 2001; Covell, Uman, & Manning, 1985; Ely, Osheroff, Chambliss et al., 2005). The goal of this research was to develop guidelines for instructing physicians in information literacy and information technology fluency. This study of physicians’ usage of electronic information resources identified the information needs that drive physician information-seeking behaviors and their limited knowledge of the resources they use.

A literature search done prior to this research did not find a consistent approach to information literacy instruction by medical schools, residency programs, or continuing
education programs to develop physicians into literate consumers of electronic medical information. Lack of expertise in using electronic information can negatively affect the care provided by physicians (Bor & Pelton, 2001a; Bor & Pelton, 2001b; CBS News, 2006; Johns Hopkins University, 2001; Leonhardt, 2006; Perkins, 2001; Ramsay, 2001).

According to the ALA, information literacy is the capacity to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (American Library Association [ALA], 1989, ¶3). Information technology fluency is defined as an understanding of the underlying concepts of technology as it is used for problem solving and critical thinking (U.S. National Research Council, Committee on Information Technology Literacy, 1999). This researcher used these definitions to develop guidelines that identify the knowledge and skills needed by physicians to understand the underlying concepts and functionality of electronic resources.

Guidelines were developed for incorporation into the physician learning experience. Since they are structured to encourage information literacy for life-long learning, an expectation of medical accrediting bodies, these guidelines would be effective in residency programs and in meeting the needs of practicing physicians through continuing medical education (Accreditation Council for Graduate Medical Education, 2008; American Medical Association, 2005a; Association for the Accreditation of Human Research Protection Programs, 2005; U.S., National Academy of Sciences, Institute of Medicine, & Committee on Quality of Health Care in America, 1999).
Hypotheses

The hypotheses of this study were as follows:

1. Physicians perceive all electronic resources as being equally current and thorough.
2. Physicians think each resource has the same level of functionality.
3. Physicians are satisfied with the results of their research whether or not they have used the most effective resource.

As shown in the literature, physicians have self-reported greater knowledge than they have demonstrated, as well as self-reporting satisfaction with the results of the information they found regardless of the quality of the results (Haynes, Johnston, McKibbon, Walker, & Willan; 1993; McGowan & Berner, 2004; Scott, Schaad, Mandel, Brock, & Kim, 2000). Physicians have also demonstrated confusion when using or describing resources (Bennett, Casebeer, Kristofco, & Strasser, 2004; Cullen, 2002; Gotta, 2005; Taylor, 2005).

Relevance, Significance, and Need for the Study

The U.S. National Academy of Sciences, Institute of Medicine, and Committee on Quality of Health Care in America (1999) report in, *To Err is Human* (1999), that mistakes in medical care account annually for more than one million injuries and nearly 100,000 deaths in the United States. In this report, the Institute of Medicine (IOM) identified information as a vital part of the solution to medical errors. The report discussed the risk created by variable information and lack of adherence to standards, and
stated that consistent treatment using the latest medical information should be a
foundation for improving health care (pp. 18-19).

The U.S. Congress initiated hearings to explore the IOM report. Former President
Bill Clinton ordered a study to investigate the feasibility of implementing the IOM
recommendations and, based on that study, issued a directive to governmental agencies to
execute those recommendations. Leape et al. (2002) questioned the IOM initiative
requiring the Agency for Healthcare Research and Quality to identify and disseminate a
list of best practices to all clinicians. Leape et al. warned of the difficulties that could be
created if policymakers waited for incontrovertible proof before establishing certain
treatment policies. Leape et al. stated that there would never be complete evidence for
every procedure administered in medicine. This gap in information also means that many
EMIPs now available to physicians have these same limitations (Boyd et al. 2005;
Wachter, 2006).

For those health care scenarios that do not have established treatment guidelines,
lack of search skills can produce incomplete search results and dire consequences. When
performing the literature search for a clinical trial in 2001, a researcher at Johns Hopkins
University missed an asthma medication’s documented adverse effect. As a result, a
participant died of an adverse reaction to hexamethonium (Ramsay, 2001). The medical
professional who performed the literature search was unfamiliar with resources well
known to information professionals that would have revealed the risk of adverse reaction
(Perkins, 2001).

According to Perkins (2001), the Johns Hopkins researcher stated that he searched
PubMed and the Web and did not find documented evidence of this hazard. Perkins noted
that the adverse effect was described in the printed literature located in MEDLINE’s paper index, *Index Medicus*, prior to 1966. Although PubMed searches literature older than 1966, that literature is not indexed using the standard NLM thesaurus for medical literature, Medical Subject Headings (MeSH), so it is difficult to get accurate results. However, Micromedex (Thompson Micromedex, 2007), a drug database with a professional reputation for thoroughness, listed the drug reaction that killed the study subject at the top of its list of potential adverse events for hexamethonium (Perkins, 2001).

Braun et al. (2004) illustrates this problem in another case in which an 84-year-old woman arrived at an emergency room suffering from difficulty breathing and loss of consciousness. Five days earlier her physician had diagnosed her with a respiratory infection and prescribed clarithromycin. The physician in the emergency room suspected pneumonia and treated her accordingly. The patient died, and the autopsy revealed that the cause of death was not pneumonia, but pancreatitis, probably caused by a rare side effect to clarithromycin.

Braun et al. (2004) acknowledged that if the physician had performed a literature search in MEDLINE on the side effects of clarithromycin, he probably would have found an article that identified this adverse effect. Braun et al. posited that the physician did not perform the literature because he did not know he needed the information on side effects; and, in any case, the physician probably would not have had the time to perform a proper search. Braun et al. further stated that the expansion and complexity of medical information sources impose an enormous burden on physicians who are often unaware of the gaps in their knowledge. Braun et al. attempted to model physicians’ information
needs to create an information template that physicians could use to help direct treatment plans. After creating 167 information-need templates, the authors agreed their approach did not narrow information needs sufficiently to create useful templates.

Another problem with relying solely on commercial EMIP resources is the lack of guidelines for comorbid conditions. When Boyd et al. (2005) addressed the issue of patients with more than one medical condition, they found that “47% of Medicare beneficiaries aged 65 years or older had at least three chronic medical conditions, and 21% had five or more” (p. 716).

In the commentary, Boyd et al. (2005) stated, “It is evident that CPGs (clinical practice guidelines), designed largely by specialty-dominated committees for managing single diseases, provide clinicians little guidance about caring for older patients with multiple chronic diseases” (p. 720). Guidelines written for combinations of diseases, however, would be “unwieldy and based on scant evidence” (p. 723). The authors stated future studies would have to be conducted specifically on older patients with representative comorbidities to provide evidence-based guidelines for the care of older patients.

Wachter (2006) also discussed the unlikelihood of creating treatment guidelines to encompass patients with the wide variety of possible concomitant conditions. The authors claimed that this lack of multi-disease guidelines plays a particularly strong role on the treatment of the elderly who are most likely to present several health problems. He used the example set forth by Boyd et al. (2005) of a hypothetical 79-year-old woman with five common diseases: hypertension, osteoporosis, osteoarthritis, type 2 diabetes mellitus, and chronic obstructive pulmonary disease. Boyd’s research revealed that, if this patient
had received therapy as recommended by the guidelines, she would have been administered 13 medicines, costing more than $4000 per year, and with more than 20 potential drug-disease, drug-drug, and drug-diet interactions (p. 2781).

This scenario illustrates the complexity that most physicians face in treating patients, particularly in an aging population. Wachter (2006) suggested that until guidelines for treatment of multiple disorders exist, more emphasis should be placed on developing physician skills in treating multiple conditions, including incorporating these skills into board certification and performance scenario training with simulated patients. Wachter cautioned that physicians must be allowed to “apply the art of medicine” (p. 2782) when confronted with multisystem illnesses until the guidelines system improves.

Misdiagnosis is another problem that persists in health care. CBS News (2006) ran a story about a woman who was misdiagnosed and treated for non-Hodgkin’s lymphoma and died as a result of her chemotherapy treatments. The autopsy revealed she had a benign tumor on the thymus gland. Dr. Elizabeth Burton of Baylor University Medical Center in Dallas told CBS News that the misdiagnosis rate has not improved over the last century. She explained that autopsies reveal a high rate of error, and that hospitals that perform more autopsies have a 12% decrease in error rates.

The nationwide autopsy rate is low; only 6% of deaths are autopsied. The misdiagnosis rate identified by those autopsies is 40%. Of that 40%, 10% to 12% of those patients, had they been correctly diagnosed, would have lived. CBS News also interviewed Larry Weed, a physician who developed his own computer system for tracking medical information. Weed laid the blame on medical schools for trying to move
complex knowledge from libraries and laboratories into physicians’ heads rather than acknowledging the complexity of the information (CBS News, 2006).

Weed’s opinion (CBS News, 2006) is seconded by Leonhardt (2006), who also argued that, to formulate a correct diagnosis, reliable medical information is essential. He reported that the frequency of misdiagnosis in medicine has not changed appreciably since the 1930s. He stated that physicians misdiagnose fatal illnesses approximately 20% of the time and treat patients for the wrong disease. Leonhardt described the case of a 4-year-old boy who had been ill for months with a fever and light brown spots on his skin. Even though the presence of the spots concerned the boy’s physician, blood tests indicated leukemia. Had the child’s physician, Dr. John Bergsagel, proceeded with the chemotherapy initially indicated, the treatment would not have cured the condition and would have only made the boy weaker. By chance, Dr. Bergsagel had read an article describing a new database, Isabel (2006), and there he found the correct diagnosis, a rare form of leukemia, whose correct treatment was a bone marrow transplant.

The database, Isabel, (2006) is named for a young girl who almost died when she was diagnosed incorrectly with chicken pox rather than necrotizing fasciitis, a flesh-eating virus. Isabel survived, and her father founded a company to fight misdiagnosis by developing a database to help diagnose children’s diseases. Physicians enter the symptoms of the presenting complaint and receive a list of possible diagnoses (Leonhardt, 2006). Isabel costs $80,000 a year for an institutional subscription and $750 for individual physicians (Isabel, 2006).

Correct information is as necessary for treatment as it is for diagnosis. People die from mistakes in medical care; accurate medical information could help to reverse this
trend (CBS News, 2006; Leonhardt, 2006; Perkins, 2001; Ramsay, 2001, U.S. National Academy of Sciences, Institute of Medicine, and Committee on Quality of Health Care in America, 1999). Because of the complexities of each disease and the difficulties of treating several diseases in one patient, finding the medical information that will help to direct treatment is difficult. Standardized guidelines cannot answer every question (Boyd et al. 2005; Diringer, 2003; Wachter, 2006). The literature clearly indicates that physicians need a greater understanding of electronic resources as they search for information to direct their treatment of patients.

**Barriers and Issues as they Apply to the Research**

The literature review for this research failed to reveal any previous studies of physicians’ e-resource preferences as they related to their comprehension or satisfaction with resources. For this reason, a questionnaire needed to be constructed. Peterson et al. (2004) and Wallingford, Humphreys, Selinger, and Siegel (1990) had executed studies that investigated some of the issues relevant to this research (see Appendix B and Appendix C). The instrument used for this study has incorporated portions of these questionnaires. Questions used in those studies allowed for comparison between previous physician attitudes towards online information resources and information gathered from this research.

Physicians were the targeted subject group, but it was not possible for this researcher, without being affiliated with a hospital or a university with a physician population, to gain access to physicians to survey. The Institutional Review Board and the Medical Education Director of Bridgeport Hospital, Bridgeport, Connecticut, initially
approved a physician survey for this study. However, the Chief Medical Officer (CMO) withdrew approval. His concerns were not based on the research; rather, he was concerned that physicians would view the questionnaire, with its subsequent follow-up letters pursuing a response, as intrusive. The CMO was also concerned that physicians would believe that their contact information had been released by the hospital to a mailing list. Hospitals court physicians because physician affiliation brings in patients, who, in turn, generate revenue. Hospital administrations are understandably protective of their physicians.

In pursuit of a subject group, this researcher contacted various hospitals where she had colleagues who offered to help her contact the appropriate administrators for permission to survey their physicians. Institutions contacted were the University of Connecticut Medical Center, Farmington, Connecticut; the Veterans Administration Hospital, West Haven, Connecticut; Indiana University-Purdue University, Indianapolis, Indiana; and Yale University, New Haven, Connecticut. In all cases, administrators were unwilling to expose their physicians to outside research by an individual because they feared it would be construed as invasive.

Colleagues in hospital libraries refused when asked to help obtain permission to survey their physicians, knowing that their site administrators would not be receptive to an outside researcher. To solve this problem, the researcher identified a company that surveys physicians and used their services to survey physicians with a Web-based questionnaire. Adaptive Management Strategies, Inc. (AMS) has a database that holds demographic information on more than 800,000 licensed physicians obtained through the American Medical Association (AMA). A random selection from this large database
would have been too diffuse to interpret reliably. Consequently, a sample was narrowed to family practice physicians in Connecticut. While the physicians sampled did not necessarily have access to the same electronic information resources, they were in a common geographic area where resources available through hospital libraries and opportunities for personal and professional society subscriptions are available nationwide.

The study’s research questions led to the development of a complex questionnaire that required the selection of and rating of resources. The Web questionnaire was programmed to simplify the complexity of the questions as subjects navigated through a detailed selection of answers. A paper version of this survey involved referring back to initial answers and skipping questions that were not relevant based on the selection of subjects of interest. The Web questionnaire automatically linked subjects to the next question, eliminating the need to flip back to the first section of the questionnaire. A list of the medical terms and their acronyms used in this research follows.

**Definition of Terms**

**Clinical practice guidelines (CPG):**

Open Clinical (2007) defines clinical practice guidelines as systematically developed statements to assist physicians with decisions regarding appropriate health care for specific clinical events. These guidelines are created using EBM research tenets.
Computer literacy:

Computer literacy encompasses the skills for using computer applications, such as word processing and e-mail (U.S. National Research Council, Committee on Information Technology Literacy, 1999).

Continuing medical education (CME):

After completion of the residency program or fellowship training, physicians can continue to receive credits for continuing medical education. Some states require a certain number of CME credits per year to ensure the doctor's knowledge and skills remain current. CME requirements vary by state, by professional organizations, and by hospital regulations and expectations (AMA, 2005a).

Electronic Medical Information Products (EMIPs):

An acronym created by this researcher to describe commercial electronic resources (e.g., books, databases, etc.) that contain reviews described by the vendors as authored by experts. These guidelines do not meet the criteria for EBM resources because they do not follow EBM guidelines.

Evidence-based medicine or evidence-based practice (EBM):

“Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research” (Sackett, Rosenberg, Muir Gray, Haynes, & Richardson, 1996, p. 71).
Fellowship:

A fellowship consists of one to three years of additional training in a subspecialty, such as gastroenterology, a subspecialty of internal medicine and of pediatrics, or child and adolescent psychiatry, a subspecialty of psychiatry (AMA, 2005b).

Graduate medical education (GME):

“The term 'graduate medical education' includes residency and fellowship training; the AMA does not use the term postgraduate education” (AMA, 2005b, ¶1).

Information technology fluency:

Information technology fluency, used for problem solving and critical thinking, enables information consumers to remain current with developments in information technology because they understand the underlying concepts (U.S. National Research Council, Committee on Information Technology Literacy, 1999).

Information literacy:

According to the ALA definition, information literacy allows one to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information” (ALA, 1989, ¶1).

Medical informatics:

The MeSH scope note (definition of a term in the MeSH database) defines Medical Informatics as the field of information science concerned with the analysis and dissemination of medical data through the application of computers to various aspects of health care and medicine. (U.S. National Institutes of Health, National Center for Biotechnology Information, 2007b). Medical informatics also encompasses the skills of information literacy in medical information systems, use of online resources, competency
in assessing databases, and use of software to make graphs, prepare presentations, etc. (Association of American Medical Colleges, Medical School Objectives Project, 1998).

Medical student:

The education of physicians in the United States is lengthy and involves undergraduate education, medical school, and graduate medical education. After earning an undergraduate degree (pre-med), a medical student must complete four years of education, including preclinical and clinical modules, at a medical school accredited by the Liaison Committee on Medical Education. Upon completing medical school, students receive their doctor of medicine degrees (MDs), and then must complete additional training before practicing on their own as physicians (AMA, 2005b).

Medical Subject Headings (MeSH):

MeSH is the thesaurus (also referred to as a controlled vocabulary) used to index MEDLINE.

Physician:

“After completing undergraduate, medical school and graduate medical education, a physician still must obtain a license to practice medicine from a state or jurisdiction of the United States in which they are planning to practice. They apply for the permanent license after completing a series of exams and completing a minimum number of years of graduate medical education” (AMA, 2005b, ¶6).

Problem-based learning (PBL):

In problem-based learning (also called active learning), students are presented with an unfamiliar clinical problem. The students work together with a facilitator to combine knowledge and information resources to solve the problem. PBL is a dynamic
process, where the group explores various resources and solutions (McMasters University, 2008).

**Resident:**

“A resident is a newly graduated MD who must enter into three to seven years or more of professional training under the supervision of senior physician educators. The length of residency training varies depending on the specialty chosen: family practice, internal medicine, and pediatrics, for example, require 3 years of training; general surgery requires 5 years. (Some refer to the first year of residency as an ‘internship’; the AMA no longer uses this term)” (AMA, 2005b, ¶5).

**Satisficing:**

The Bernard Schwartz Center for Economic Policy Analysis History of Economic Medicine (2006) described Herbert A. Simon’s theory of satisficing as “setting an aspiration level which, if achieved, they will be happy enough with, and if they don't, [they will] try to change either their aspiration level or their decision” (¶3).

**Summary**

More electronic resources become available to physicians every year, and many physicians, especially those newer to the profession, use commercial EMIPs to find information (DeZee et al, 2005; Ely, Osheroff, Chamblis et al, 2005; Peterson et al., 2004; Schilling et al., 2005). The limitations of these resources and of physicians’ ability to use them effectively have been identified in the literature as problematic (Chumley et al., 2006; Cullen, 2002; Johns Hopkins University, 2001; Linton et al., 2004; McGowan & Berner, 2004).
Professional organizations, residency-accrediting bodies, physician-accrediting bodies for continuing medical education programs, and the government accrediting bodies for treatment guidelines all expect physicians to be able to locate current information in the literature. They expect physicians to incorporate the information they find into their treatment plans and thereby protect patients from medical errors or substandard care. Physicians also are expected to use these resources for life-long learning to ensure ongoing quality of both patient care and medical research (Accreditation Council for Graduate Medical Education, 2008; American Medical Association, 2005b; Association for the Accreditation of Human Research Protection Programs, 2005; U.S. National Academy of Science, Institute of Medicine, and Committee on Quality of Health Care in America, 1999). Incorporating literacy standards into the physician learning experience can help meet these expectations.

The ACRL (2000) stated that information literacy forms the basis for life-long learning and is common to all educational disciplines. The ACRL found that information technology skills are an integral part of information literacy, citing the NRC (U.S. National Research Council, Committee on Information Technology Literacy, 1999) report that promoted information technology fluency.

Unlike computer literacy, which involves learning hardware and software applications, information technology fluency represents an understanding of the underlying concepts of technology as they are used for problem solving and critical thinking (U.S. National Research Council, Committee on Information Technology Literacy, 1999). Information literacy and information fluency standards for physicians would facilitate the ability to understand the construction of electronic information
resources and the differences among search engines, enabling physicians to be better-educated users of information technology. Their literacy would not only lead to more accurate search results, but also would help physicians keep abreast of current, relevant information, arming them with both the broad concepts and the specific skills necessary to get the most out of these resources.

The goal of this research was to combine the established literacy resources with the findings of this study to develop guidelines. These guidelines provide a model for programs that educate physicians to meet the expectations of accrediting bodies. Programs using these guidelines to expand physicians’ knowledge of electronic resources will enable them to stay current with electronic information developments throughout their careers.
Chapter 2

Review of the Literature

Historical Overview of Electronic Medical Information Resources

In 1965, the Medical Literature Analysis and Retrieval System (MEDLARS) became accessible via computer. The first iteration of MEDLARS was a batch system that used tapes to store the data sequentially. The system allowed *Index Medicus* to be accessible online and eliminated the time-intensive task of searching paper volumes year-by-year for relevant citations (Buckley, 1975). MEDLARS was the first electronic resource available to health care professionals. Renamed MEDLINE, this resource, and various interfaces built to simplify its use, dominated electronic access to health care information from the 1960s through the 1990s.

MEDLINE is not a simple database to learn. Before the ubiquitous presence of the computer, the medical literature had to be searched manually using *Index Medicus*, the paper index produced by the National Library of Medicine (NLM). Medical Subject Headings or MeSH, the thesaurus used for indexing *Index Medicus*, continues to be used for MEDLINE. MeSH has a complex, hierarchical structure with thousands of cross references and subheadings. Searching using MeSH and other limiters (title, abstract, author, year, institution, and source) by means of Boolean logic allows a searcher to retrieve the most complete and reliable data from MEDLINE (Coletti & Bleigh, 2001).
In 1993, Lindberg, Siegel, Rapp, Wallingford, and Wilson stated that MEDLINE searches met a wide variety of clinical information needs and were particularly valued for providing information that positively affected patient care outcomes. The authors reported on the NLM survey of health care professionals’ use of MEDLINE. In a telephone survey, 552 study participants reported they turned to MEDLINE because, in many cases, it was the only link locally available, but also because it was inexpensive, easy to use, and convenient. These features are no longer exclusive to MEDLINE. Commercial EMIPs, with their full-text search results, have radically changed the information landscape for physicians.

MEDLINE continues to be universally available at no cost as part of PubMed, the NLM interface for MEDLINE and other government-sponsored databases. Vendors such as Ovid and EBSCO repackage MEDLINE with different, user-friendly search interfaces for a fee. MEDLINE is also the primary resource used for the research done to produce the evidence-based clinical practice guidelines in EMIPs such as UpToDate and eMedicine.

MEDLINE Interface Development

It is important to understand the development of MEDLINE by the government as this helps to explain the complexity of the database. MEDLINE was the first medical database made accessible to physicians and continues to be the resource used for all medical research. Other information products must rely, at least to some degree, on the bibliographic data made available by MEDLINE, as this is the only comprehensive medical information resource of its kind.
Citations are gathered from over 4,600 international journals to comprise the MEDLINE database of over 13 million references (U.S. National Library of Medicine, 2002a). The original database began in 1966, but retrospective conversion of data allows MEDLINE developers to add historical data on an ongoing basis. OLDMEDLINE, built after MEDLINE was computerized, searches an additional 1,700,000 citations back to 1951. The historical portion of the database, however, does not include MeSH terms and therefore returns different search results from present-day MEDLINE (U.S. National Library of Medicine, 2004).

In an attempt to simplify MEDLINE searching, various vendors developed user-friendly interfaces. PaperChase, Data-Star, BRS After Dark, BRS Colleague, DIALOG-Medical Connection, and Physicians Online were among the first interfaces to be marketed directly to physicians (Abate, Shumway, & Jacknowitz, 1992; Haynes, McKibbon, Walker, Mousseau, Baker, Fitzgerald, et al., 1985; Horowitz, Jackson, & Bleich, 1983; Jacobs, Edwards, Graves, & Johnson, 1998; Lyon, 1989; Smith, Darzins, Quinn, & Heller, 1992). In addition, the free NLM interface, first called GRATEFUL MED, then Internet GRATEFUL MED and now PubMed, continued to evolve, necessitating ongoing training to familiarize users with new features (U.S. National Network of Libraries of Medicine, National Training Center and Clearinghouse, 2007).

Physicians traditionally have relied on their own expertise and the expertise of their colleagues to augment their knowledge of a particular condition (Friedland, 1998). Physicians are now faced with a wide selection of electronic information resources, each using a different interface, and focusing on a different facet of medical information. Alper, Stevermer et al. (2001) evaluated 14 full-text databases designed to answer clinical
questions. Using 20 questions that might occur in a clinical setting, the top five databases answered 50% of family physicians’ questions. Using two or more databases provided answers for 75% of the questions.

These results might give the impression that reliable clinical information can be located with some regularity. There was no discussion of levels of completeness of information provided by these disparate resources. Since the same two physicians performed all the searches, it is reasonable to assume that they were facile searchers whose results would improve as they repeatedly searched the same questions in different databases.

Many articles compare and contrast various interfaces. Each interface works differently, providing different results depending on the interface used. Haynes, McKibbon, Walker, Mousseau et al. (1985) reviewed 14 MEDLINE interfaces for retrieval quality, ease of use, accuracy, and cost. Haynes, McKibbon, Walker, Mousseau et al. noted that the systems that cost the least, used the least amount of time, and rendered the most accurate search results, were also the most difficult to learn. They also found that the simplified interfaces created for MEDLINE at that time sacrificed precision.

Searchers could logically assume that all interfaces would deliver similar results because they were all searching MEDLINE. Hallett (1998) compared the controlled vocabulary systems used in the Ovid and Dialog interfaces to MEDLINE. She emphasized the importance of using MEDLINE’s MeSH vocabulary to achieve the best outcomes. Search strategies for nine scenarios were composed using MeSH terms and subheadings. Ovid demonstrated a high level of accuracy, while Dialog retrieved a
substantial number of irrelevant resources. This occurred because Dialog searched not only the MeSH terms, but also those parts of the term that appeared within other terms.

**Controlled Vocabulary**

Searching MEDLINE accurately depends on understanding MeSH headings and using them effectively. Even before the heavy use of electronic resources, physicians were not always effective searchers of medical literature. DaRosa, Masi, Dawson-Saunders, Mazur, Ramsey, and Folse (1983) observed search behaviors of 38 residents and physicians asked to research the answer to a patient care question. *Index Medicus* was used (the old paper version of MEDLINE), but then, as now, most users were unaware of MeSH. Rather, they would browse until they found the most appropriate term. Searchers were frustrated because, without correct use of MeSH terms, their search results were often too broad or too narrow and did not retrieve the needed information.

Delozier and Lingle (1992) cited their personal observations that end-users found using the “unique features of MeSH frustrating and complicated” (p. 34). They concluded that although new interfaces made using MeSH and other complex features of MEDLINE more accessible, most users still found it daunting.

McKinn, Sievert, Johnson, and Mitchell (1991) tested free-text searching against using MeSH terms and found that free-text searching identified significantly more articles but MeSH terms delivered articles that were more relevant. When Verhoeven, Boerma, and Meyboom-de Jong (2000) compared GRATEFUL MED software, MEDLINE on CD-ROM, and *Index Medicus* they found that *Index Medicus* was the most effective method for literature retrieval. They speculated that it was because *Index*
Medicus only allowed searching by MeSH terms and that the software allowed free-text searching and therefore less control over the accuracy of search terms.

Lowe and Barnett’s (1994) thorough article explaining the hierarchy of MeSH stated that MeSH improved accuracy because of the precision of MeSH indexes. The authors also discussed the limitations of MeSH, including the difficulty of finding the correct term. MeSH is notoriously unpopular with physicians because of its intricacy (Calabretta, Mikita, Warner, Bryant, Devlin, & Laynor, 1990; Taylor, 2005; Wildemuth & Moore, 1995). MeSH complexity can seem a waste of time if the benefits of this tool are not fully understood.

Researchers have investigated physicians’ skills at constructing searches and their perceptions of their search abilities. Motivated by the idea that little is known about how users formulate their search strategies, Wildemuth and Moore (1995) analyzed 161 MEDLINE search strategies conducted by 58 third-year medical students. Their strategies included entering a single-word term, free-text term phrasing, and combining sets of terms. They found that 37% of 500 search statements contained at least one error and that 75% of the search statements contained what they defined as missed opportunities. The most common missed opportunity was the failure to use MeSH terms rather than free-text terms or the failure to explode (expand) a MeSH term to include a broader definition of the term. Students, however, judged the search results as adequate and were satisfied with the results of their searches.

Federiuk (1999) explained additional nuances of MEDLINE search construction. Twenty common medical abbreviations and acronyms (e.g., HIV, COPD, STD) were selected and searched in MEDLINE using Ovid. Some abbreviations mapped (i.e., were
automatically routed from a term to the appropriate MeSH heading) but less common abbreviations (e.g., GCS for Glasgow Coma Scale) did not. She also warned that MeSH terms were case sensitive, another feature that prevented search terms from consistently mapping to the correct MeSH term.

Gault, Shultz, and Davies (2002) compared variations in MeSH mapping capabilities across various MEDLINE interfaces. Patrons’ search requests were parsed into terms or phrases and then converted into MeSH. Search interfaces tested were Internet GRATEFUL MED, Ovid, PubMed’s MeSH Browser, PubMed Index, FirstSearch MeSH Heading Phrase, and FirstSearch MeSH Heading.¹ The results demonstrated that these interfaces did not map the same terms in the same way and did not consistently map to the correct MeSH headings. Coletti and Bleigh (2001) noted that, even when a term mapped correctly to the MeSH term, there was no feedback from the database to the user. Users had no way of knowing the database was mapping to the correct term; it appeared to them that a database arbitrarily jumped from one term to another.

Sievert, Patrick, and Reid (2001) provided yet another description of the problems with MeSH and mapping. Although PubMed maps terms like “heart attack” to “myocardial infarction,” not all terms automatically map. “Bloody nose” and “pink eye” were two common terms that did not map to the correct MeSH terms (“epistaxis” and “conjunctivitis”).

To address this problem, the NLM developed the Unified Medical Language System (UMLS) metathesarus (U.S. National Library of Medicine, 2002b). Schuyler, Hole, Tuttle, and Sherertz (1993) described this initiative as a “compilation of names, ¹ http://firstsearch.oclc.org
relationships, and associated information from a variety of biomedical naming systems representing different views of biomedical practice or research” (p. 217). NLM’s initiative to provide a broader thesaurus may eventually enable the NLM databases to (a) map terms that are missed currently, (b) search across disparate databases, and (c) facilitate accurate text-word searching in MEDLINE. Since MeSH has been identified as an obstacle in the successful training of searchers, this functionality would greatly increase the accuracy of MEDLINE searches (Federiuk, 1999; Marshall, 1989; McKinn et al., 1991; Sollenberger, 1987).

However, Sievert et al. (2001) found that even the UMLS did not include common terms like “bloody nose.” On the positive side, while UMLS did not contain “color blind,” it did include “color blindness.” It also included both spelling variants for “pink eye” (“pink eye” and “pinkeye”) and both British and American spellings (“colour blindness” and “color blindness”), another subtlety in searching that could affect results.

UMLS is an ongoing project, and researchers and software engineers continue to improve the accuracy of text-word searching. Disambiguation of biomedical terms is now the focus of attention. In 2008, Stevenson, Guo, Gaizauskas, and Martinez described the application of applying Word Sense Disambiguation (WSD), tested with natural language texts, to the biomedical literature. Fifty terms which were identified as ambiguous in UMLS were selected to create a test NLM-WSD data set, such as “cold (temperature or illness),” “culture (anthropological or laboratory test),” and “discharge (release from care or liquid emission from a wound.” Stevenson et al. reported that the most accurate search results came from using WSD with manually assigned MeSH terms. The UMLS Concept Unique Identified that make up the automatic mapping feature of UMLS, did not improve
the performance of the mapping function unless they were used with MeSH. The hierarchical design of MeSH makes it a powerful search tool.

To use MeSH effectively requires considerable training. Realizing that physicians needed immediate answers to clinical questions, the NLM developed a search-hedges function for the MEDLINE interface. Haynes and Wilczynski (2004), part of the Hedges Team for PubMed, created search hedges, e.g., canned searches constructed from a gold-standard search. Gold-standard searches are search strategies constructed and tested until NLM judges them to be the most thorough and effective search strategy for a particular question.²

Although MEDLINE interfaces were developed to make searching easier for health care professionals, they also fostered the expectation that searching did not have to be difficult. Health care professionals are not interested in learning how to be cautious consumers of new interfaces. Medical librarians and health care professionals who were adept searchers attempted to correct this problem with training.

Users prefer to search resources that do not use thesauri. Of the resources that are the focus of this research, only MEDLINE via various interfaces and PubMed use controlled vocabulary, and features have been developed to allow the search to map to MeSH headings without the searcher having to know the correct term. Google, Yahoo, UpToDate, eMedicine, Medscape/WebMD, MDConsult, Micromedex, and ePocrates do not use standardized vocabulary. Fenton and Badgett (2007) underscored the importance of vocabulary standardization. In their study, they had to redesign their protocol to

² These hedges are found in the Clinical Queries section of PubMed (http://www.ncbi.nlm.nih.gov/entrez/query/static/clinical.shtml).
substitute the term “cancer” for the MeSH term “neoplasm” due to UpToDate’s inability to process MeSH terms.

Training Initiatives for MEDLINE

Librarians became the obvious choice as trainers for MEDLINE because of their expertise in using a command language to search the old MEDLARS system (Ikeda, 1992). Command language involved knowing a series of codes (TI for title, MH for MeSH heading, TW for text word, etc.) and identifying the MeSH terms using the paper indexes. These terms were typed into a DOS screen as a search string. The NLM developed a train-the-trainer program to teach experienced librarian searchers how to train novice users on GRATEFUL MED (the graphical user interface version of MEDLINE) and on the next generation of MEDLINE, PubMed (U.S. National Network of Libraries of Medicine, 2008).

Librarians and physicians developed a variety of training programs to improve search expertise by emphasizing precision. Ikeda (1992) surveyed graduates of a doctoral pharmacy program who had been trained in online searching and found that, of 151 pharmacists, 71% continued to search to augment their professional knowledge after graduation. In addition, the pharmacists used a wider variety of online resources and retained their understanding of search terminology. Ikeda also identified a behavior that foreshadowed one of the ongoing difficulties with end-user searching. She found that searchers frequently failed to search older articles for information, probably assuming that the current information would be the most relevant for drug research. This behavior caused the death of the research subject in the Johns Hopkins study, where older material
would have revealed the adverse reaction that caused the death of a research subject (McLellan, 2001; Pelton, 2001; Perkins, 2001; Tomlin, 2002).

McKibbon, Haynes, Dilks, Ramsden, Ryan, Baker, et al. (1990) tested the quality of MEDLINE searches performed by physicians and physician trainees and compared the searches to those of expert searchers (clinicians and librarians). Librarians equaled experienced end-users in the number of articles found and exceeded them in finding relevant articles. As end-users performed more searches, their totals improved, but relevance remained suboptimal. Several researchers stated that physicians needed to devote more time to learning the advanced search tools, such as MeSH and term exploding. Using the Explode feature in MeSH allows a searcher to select a general term from the MeSH Thesaurus tree and include specific terms listed under that term. For example, exploding the MeSH term “sepsis” would also include the more specific term, “septicemia.”

Calabretta et al. (1990) were among the first to use computer-assisted instruction to teach MeSH. The authors acknowledged that the real obstacle to teaching MeSH was convincing library users to take advantage of the training tool. Throughout training efforts, physician and student populations rebelled against the intricate system of headings, subheadings, and other limiters designed to search MEDLINE.

Hostility towards learning MeSH complicated training efforts. Since studies had indicated MeSH produced the most accurate search results (McKinn et al., 1991) and trainers saw higher user satisfaction when MeSH was used (Marshall, 1989; Sollenberger, 1987), most training programs were directed toward mastering MeSH. From the first, however, users were resistant to learning the complexities of MEDLINE,
let alone MeSH. The problems Kolner, Dalrymple, and Christiansen (1986) identified when training medical students to use MEDLINE are still valid today. Included in these problems were: (a) students did not perceive their deficiencies in information retrieval, (b) medical school curricula were so demanding that competition for a student’s time was considerable, and (c) students found it difficult to develop specific skills in information retrieval through lectures. Objections to MeSH were understandable. Ekstrand (1991) described the complications faced by a searcher attempting to do a precise search in the radiology literature. The elaborate search strategies were beyond the skills of most researchers who used MEDLINE regularly.

Rather than simply instructing physicians on how to search, Laine and Weinberg (1999) proposed strategies to help physicians keep up-to-date with the medical literature. The authors described management techniques for print and electronic resources and suggested that physicians develop a mission statement to identify the areas in which they wished to stay current. They recommended that the NLM MeSH system be used to categorize topics and design searches for those areas listed in the physician’s mission statement.

It should be noted that Laine and Weinberg (1999) exhibited some gaps in their knowledge. They referred to PubMed as MEDLARS, the old term that encompassed the original online effort. In addition, they listed the Web address for the NLM, rather than giving the PubMed address. However, when they recommended using MEDLINE searches to answer clinical questions at the point of care, they correctly referred to the database as MEDLINE. Although these are small details, confusion around the standard database terminology may indicate gaps in information literacy.
Training is still important today, especially as the interfaces and the resources continue to change. Hersh, Crabtree, Hickam, Sacherek, Rose, and Friedman (2000) stated, “The continuing challenge is to build more effective systems and to teach users how to use them for maximum benefit” (p. 330). The answer may exist, in part, in improving search engines, but training needs to be developed also to help physicians understand the layers of information available in MEDLINE and other resources.

A review of training programs revealed troubling results. In a review of the literature, Garg and Turtlet (2003) found only three small and methodologically weak studies that met their inclusion criteria. Of these, two showed a positive effect for training physicians to use electronic health databases; regardless of the results, users believed training was valuable. Garg and Turtlet also identified problems in developing effective training programs; there was no set benchmark of the level of skill needed to search the literature effectively.

Brettle (2004) also performed a systematic review of the literature on information skills training, emphasizing the importance of this skill if physicians wished to practice effective EBM. Brettle stated that study design, execution, small sample size, or inappropriate outcome measures produced flawed results in many of the studies. The studies were also difficult to compare because they were highly heterogeneous, with different settings and training methods. Like Garg and Turtlet (2003), she found that users valued training overall, particularly EBM training from librarians. While training physicians to use library resources to research EBM problems seemed to be effective in some cases, Brettle (2004) noted substantial duplication of effort across training programs.
Reports of the complexity of MeSH and of health care professionals’ resistance to using MeSH demonstrated the difficulties involved in teaching physicians to become expert searchers in MEDLINE. Trainers began to focus on EBM training both in paper resources and in leveraging the EBM resources available in MEDLINE. These included the previously described hedge searches (Haynes & Wilczynski, 2004).

**The Integration of EBM into Training**

The Accreditation Council for Graduate Medical Education (ACGME) and other accrediting bodies are mandating the training of residents in EBM search skills. It is not clear, however, how this training should be offered, what electronic resources should be used, or who should provide the training (Accreditation Council for Graduate Medical Education [ACGME], 2008; American Medical Association [AMA], 2005b; Association for the Accreditation of Human Research Protection Programs [AAHRPP], 2005; U.S. National Academy of Sciences, Institute of Medicine and Committee on Quality of Health Care in America, 1999).

Most training aimed at demonstrating the importance of EBM searches to physicians. PubMed has many features that allow for accurate EBM searches, as demonstrated by Gallagher, Allen, and Wyer (2002). They described search techniques to locate clinical information for the busy emergency room physician, acknowledging, as did Diringer (2003), that commercial EMIPs were not likely to cover the unique situations found in an emergency room.

In 2003, Ebbert, Dupras, and Erwin published a training article for physicians explaining how to locate EBM guidelines in PubMed rather than resorting to EMIPs.
They presented three separate, clinical case studies, which clearly demonstrated how to formulate a search in PubMed, using the features built into the interface. Ebbert et al. cautioned that EMIP reviews might not be current and also suggested that clinicians might have more specific questions that would be better answered by one specific article rather than commercial EMIP’s subject reviews.

Thom, Haugen, Sommers, and Lovett (2004) reported on an EBM curriculum developed for family practice interns. A web-based EBM tutorial and written tests were used to evaluate their EBM skills and knowledge. Faculty self-reported incorporating EBM into their teaching 92% of the time and into their practice 75% of the time. Residents self-reported applying EBM skills to patient treatment 86%. Unfortunately, there was no mechanism to validate the self-reports.

Physicians attempting to create instruction programs for EBM appear to be aware of the complications inherent in EBM instruction. When Slawson and Shaughnessy (2005) discussed strategies for teaching physicians information skills, they acknowledged that physicians could not be expected to be expert information managers as well as expert clinicians. They discussed the limitations of EBM, and acknowledged that the most common method of information management is “satisficing,” “whereby busy clinicians will be satisfied with the information they have at hand, sacrificing quality for convenience” (p. 685). Satisficing, a term initially coined by Herbert Simon (Bernard Schwartz Center for Economic Policy Analysis History of Economic Medicine, 2006), occurs when users are satisfied with their search results because they believe the information will suffice for that particular situation. Physicians, they found, did not strive to find the most rigorous evidence, but, instead, relied on summaries and guidelines that
might not be evidence-based. Ideally, they stated, physicians should be setting aside one or two hours each week to review the literature and draw their own conclusions.

Slawson and Shaughnessy (2005) also identified the difficulties encountered when relying on EBM for uncommon problems in a clinician’s experience. They believed it was unlikely that the clinician, if unfamiliar with the problem, would be aware of new developments in the field, or even of possible contraindications of treatment within the scope of an unfamiliar specialty. Slawson and Shaughnessy (2005) suggested patient-centered information management as a reaction to the “limited ability of EBM to meet the needs of clinicians in active practice” (p. 686). They identified the skill needed by students, residents, and practicing physicians as the ability to select information tools and make decisions by combining the best evidence with the needs and desires of the patient. They proposed the use of POEMs (Patient-Oriented Evidence that Matters), a commercial EMIP.

Bhandari, Montori, Devereaux, Dosanjh, Sprague, and Guyatt (2003) examined barriers to implementing EBM in the daily care of surgical patients. Residents identified lack of education, time constraints, lack of priority, and staff disapproval from more traditional physicians. The authors recommended curriculum reform to encourage the use of EBM.

User Satisfaction with Search Skills

From the inception of end-user searching of electronic databases, librarians have been concerned with the quality of physician-performed searches. Plutchak (1989)
editorialized on the satisfied and inept end-user, and the professional responsibilities of a medical librarian watching a searcher who is inept but happy with the results.

Even when searchers’ results were not as accurate or complete as search results produced by librarians, high user satisfaction has been reported consistently in the literature. Haynes, Johnston et al. (1993) trained 392 physicians and residents to search MEDLINE; at the end of 10 months, both groups had improved. Physicians reported they enjoyed doing their own searching and were satisfied with the majority of their search results even though they retrieved half as many relevant citations as librarians.

Other studies also examined physicians’ satisfaction with their search outcomes. Wallingford, Humphreys, et al. (1990) reported the results of a large NLM survey of 4,300 health care professionals. Of the 2,970 responses, almost three-fourths indicated they were satisfied with their own searches. McKibbon and Walker-Dilks’ (1995) review article on end-user searching concluded that end-users were usually satisfied with their results. They also found that most physicians preferred to perform their own literature searches. Many reasons for this were offered in the various studies, but McKibbon and Walker-Dilks found that most authors reported that often it was simply that end-users “enjoy the process and are confident in their results” (p. 193).

The effect of literature searching on patient care has been debated in the literature. Haynes, Johnston et al. (1993) reported that more than 50% of 392 physicians and residents perceived that their ability to care for their patients had improved after search training. Haynes, McKibbon, Walker, Ryan, Fitzgerald, and Ramsden (1990) found an effect on quality of clinical care in an earlier study as well, but in both studies,
improvements in patient care were self-reported. Hersh and Hickam (1998) concluded from their literature review that the effect on patient care had not been well documented.

In the same study, Haynes, McKibbon, Walker, Ryan et al. (1990) measured search strategies to evaluate the proficiency of 154 health care professionals. After comparing the search strategies and results to the same searches performed by librarians, they found that health care professionals retrieved only 55% of the relevant articles retrieved by reference librarians and retrieved 50% more irrelevant articles. Once again, health care professionals were satisfied with their results, despite their results being less than optimal.

Physician satisfaction has carried over to the new resources. McGowan and Berner (2004) cited several articles that described the gap between students’ perceptions of their expertise in evaluating Web resources and medical educator’s judgment of their competence. McGowan and Berner cited Scott et al. (2000) who found that while approximately half of matriculating medical students believed they were capable of critically evaluating Web resources, their medical educators disagreed with that perception.

In 1998, the Association of American Medical Colleges (AAMC) created information literacy goals for medical schools. McGowan and Berner (2004) cited data from the AAMC (2002) that 55% of the over 14,000 students who responded to the AAMC questionnaire felt confident using a variety of telemedicine applications that were not widely used and to which it was unlikely they were even exposed while in medical school. Over 93% of these students also believed they were capable of performing sophisticated searches. Their medical educators disagreed with the students’ self-
assessments. In spite of AAMC’s Medical School Objectives Project (MSOP) recommendations and ongoing research, a standardized approach to information literacy in medical schools has not been adopted.

Krause, Roulette, Papp, and Kaelber (2006) used skill objectives drawn from AAMC’s MSOP to create a questionnaire that asked first and second-year medical students to rate their skills. Students rated their ability to access databases of clinical information as low, but rated their competency in using online resources as high. It would seem evident that one would need to be able to access databases competently to use online resources, which may be why students expressed a need for formal training in this area.

Searchers, it seems, will be pleased with their results when they find sufficient information to fulfill their immediate need, referred to earlier in this document as satisficing (Slawson & Shaughnessy, 2005). Ely, Osheroff, Ebell, Chambliss, Vinson, Stevermer, et al. (2002) clearly expressed the dilemma a physician faces when looking for information by stating that, “Much has been written about the qualities of a good question, but little about the qualities of a good answer“ (p 1).

Searchers do not know if they have found all the information available through a literature search or even if it is the most accurate information, but they report themselves satisfied. If health care professionals are content with their searching abilities, they will not perceive a need to avail themselves of more focused electronic resources training.
Full-Text Journals and Quality of Research

Physicians are busy professionals who bear the responsibility of care for their patients. As office time becomes more precious, physicians do not have time to search for answers to each question that comes up during the day. Alper, Stevermer et al. (2001) cited studies showing that physicians, on average, spent less than two minutes seeking an answer to a question and concluded that most clinical questions remained unanswered. EMIPs offer a possible solution to this dilemma because they are easily searchable and full-text. Concerns as to the reliability of these resources and their applicability to certain kinds of questions have been raised (Chumley et al, 2006; Cullen, 2002; Diringer, 2003; Linton et al., 2004; McGowan & Berner, 2004).

Even before the advent of EMIPs, information professionals had concerns about how ease of use would affect quality of information. Although the immediacy of the resource is important, librarians worried that full-text journals would be selected solely based on convenience. Bane (1995) noted that library staff had observed that users were reluctant to use journals that were not available online in full text, but their research did not corroborate this observation. He observed that students would modify research topics or ignore key articles that were not full-text, and that full-text articles were strongly preferred by students and faculty who needed articles faster than interlibrary loan could supply them.

The literature is sprinkled with anecdotal comments from librarians that users’ preference for full-text would drive users to sacrifice a quality resource. Again, research did not corroborate this. Jackson, Brook, and Sisk’s 1999 article is a typical example of such assumptions coloring results. Although their limited study did not prove that full-
text access affected the quality of information used by students, the authors nevertheless concluded that convenience would tempt students studying at home to choose easily accessible full-text articles on their computer rather than a better print resource housed at the library.

According to De Groote and Dorsch (2003), physicians’ preferences for ease of use strongly influenced their choice of resources. A survey of 471 faculty, residents, and students assessed journal use online and in print. Of the 188 (41%) surveys returned, 71% of respondents preferred to access journals online. It is significant that 56% never used the available EMIPs even though they were full-text. Rather, users went to full-text journals, with Journals@Ovid being the most popular access point. The authors admitted that the high use of Journals@Ovid could have been due to Ovid’s MEDLINE interface linking directly to the full-text of articles identified by searches, making this a one-step effort.

Surprisingly, 75% of survey respondents never used any of the other full-text databases that provided access to over 2,000 online journals. De Groote and Dorsch (2003) attributed this, in part, to the “path of least resistance” (p. 236), speculating that users were either unaware of the other full-text resources or chose not to “expend the effort” (p. 236) to exit one database and go to another. They reported anecdotally that students and faculty had admitted to using Ovid’s MEDLINE interface because of ease of use and some admitted to using only articles available full-text in Ovid and ignoring full-text offerings from other databases or the paper collection “even if their information need ha[d] not been satisfied” (p. 236).
De Groote, Shultz, and Doranski (2005) continued to study possible impacts that full-text access had on physicians’ use of information resources by researching the citation patterns of physicians. They looked at the journal articles identified in physicians’ research to determine if the physicians had limited the resources they used in their research to journal articles that were available electronically. They analyzed citations from years identified as before the availability of electronic journals and years identified as after the availability of electronic journals. They reported that, although the number of journals cited per year continued to increase, the results did not indicate that researchers cited fewer articles from print-only journals, nor disproportionately more from online journals.

While the accessibility of full-text journals does not appear to have a negative impact on the quality of research, there are numerous advantages to using full-text resources. Haynes, McKibbon, Walker, Ryan et al. (1990) reported that 47% of 154 health care professionals had reported that search results affected clinical decisions. These clinical decisions, however, were based often on minimal information, such as abstracts, since this was before the advent of online links to full-text articles. Even now, the number of full-text articles in MEDLINE is dependent on the collection holdings of the hospital medical library or academic institution with which a physician is affiliated.

Full-text articles are considerably more desirable than abstracts since abstracts can produce an erroneous or incomplete understanding of the information summarized. Pitkin, Branagan, and Burmeister (1999) analyzed abstracts for research articles published in six major medical journals: *Annals of Internal Medicine, British Medical Journal, Journal of the American Medical Association, Lancet, Canadian Medical Journal,*
Association Journal, and New England Journal of Medicine. The authors found that although the proportion of flawed abstracts varied from 18% to 68% across journals, inconsistency between abstracts and the full text of the article was a common occurrence.

It appears that, rather than discouraging scholarly pursuit, easy access to electronic journals had actually encouraged users to access more information (De Groote, Shultz et al. 2005). Full-text journals also obviated the need to use the abstract rather than the article to make patient care decisions, reducing the risk of using faulty information (Haynes, McKibbon, Walker, Ryan et al., 1990; Pitkin et al. 1999). Some librarians, however, remained scornful of the preference for full text, especially by students (Bane, 1995; Jackson et al., 1999), as in Rockliff’s (2004) reference to “lazy users who no longer wanted to walk 20 meters to the bound journal shelves” (p. 435).

Ascribing the popularity of commercial EMIPs to the convenience of full-text information is overly simplistic. A review of the literature on full-text journal preference suggests that the gathering of the information that EMIPs provide in an electronic format is the more attractive feature for a busy clinician who may not understand that EMIPs do not provide a complete review of the literature and the meta-analysis necessary for EBM. The literature also revealed the unpopularity of controlled vocabulary such as MeSH, which would also make EMIPs attractive.

Information Retrieval and Legal Liability

The death of the Johns Hopkins research volunteer raised awareness of the responsibility of researchers to their subjects (Bor & Pelton, 2001a), but legal concerns regarding physicians’ obligation to stay current had previously been addressed in the
legal literature. Historically there had been speculation regarding the liability of health care practitioners and electronic resources. In Chester’s (1991) article regarding electronic malpractice, he cited scenarios, both medical and legal, in which failure to use the appropriate literature source was judged negligent. Chester discussed the case of a research chemist who checked the recent literature but failed to consult 50-year-old textbooks that identified a particular chemical as hazardous; the chemist was found negligent. Although medical malpractice for poor literature searches was not yet an issue in 1991, the author made a case that information technology might be a more critical component of such cases in the future.

In 1994, Feldbaum raised the same issue, noting that MEDLINE had become so universally accepted that not using it could be viewed as a form of negligence. He described the case of a physician who was found negligent for failing to conduct research to provide a patient with information that would have enabled a more informed decision. Feldbaum discussed the locality rule that allowed physicians to be judged on the highest possible standard of care dependent on where they were located. This rule was important before computers, when rural physicians were isolated and had access to minimal information. He cited a court case where the locality rule was overruled because of the availability of information via computers to all practicing physicians. The expectation of the court was that a physician should be able to locate information relevant to treatment. This implies that the physician should be able to perform a reliable search.

In 2002, Noah stated that board-certified specialists, regardless of their location, were all held to the same expectations of knowledge. He suggested that new technologies might complicate the physician’s ability to share consistent information, and that authors
of clinical practice guidelines might be vulnerable if their guidelines were not based on defensible findings in the literature. Noah believed that regulatory agencies and courts would expect proponents of EBM to view the medical literature with a critical eye.

In 1997, Kacmar recommended that physicians perform a literature search during the course of treating a patient in order to stay current with changes in treatment. He observed that current information obtained from the literature search could be a significant factor in modifying treatment and that this information already was used to convince insurance companies to pay for new procedures.

Although Kacmar (1997) stated that physicians had not yet been sued for neglecting to search the literature, he speculated that, as MEDLINE use became more widespread, the assimilation of new information in the medical community would become more rapid and this would create the expectation that all practicing physicians would use the latest information. In the future, physicians could be held accountable for information available to them online, and for this reason, he urged physicians to perform literature searches.

Ramsay (2001) discussed liability in reference to the Johns Hopkins clinical trial death. The committee investigating the death concluded that the Internal Review Board (IRB) had insufficient evidence to be confident that there was no risk to study participants, but no legal action was taken. Participants in a clinical trial at the University of Oklahoma, however, brought legal action against individual members of an IRB (Ramsey, 2001). This marked the first time that IRB members had been sued for a clinical trial error. The lawsuit eventually was dismissed, but the law firm representing
the Oklahoma plaintiff has since filed suits naming similar defendants at other sites conducting the same clinical trial (Serio & Tichner, 2005).

IRBs at major institutions, such as the University of Pennsylvania and Johns Hopkins University, review and monitor as many as 2,000 to 3,000 trials and rely heavily on the integrity and expertise of individual researchers. IRB committee members may be on staff with full-time responsibilities at the institution sponsoring the research or they may be volunteers who hold full-time positions at other institutions. For this reason, Ramsay (2001) stated that it was unreasonable to assume that they could do as thorough a job as might be needed.

After the death of the Johns Hopkins clinical trial participant, several articles dissected the literature review that had been performed to support the clinical trial application. Authors who reviewed the search performance found a plethora of older articles that mentioned the toxic properties of hexamethonium (McLellan, 2001; Pelton, 2001; Perkins, 2001; Tomlin, 2002). These authors also mentioned the complexity of searching the medical literature. McLellan found two relevant articles about hexamethonium dated before 1966 that could not have been found in PubMed, but were available in OLDMEDLINE, a pre-1966 database.

As mentioned earlier in this report, PubMed does not search OLDMEDLINE because the indexing terms of the older citations were not assigned MeSH headings (U.S. National Library of Medicine, 2004). No abstracts are available prior to 1966, which makes it difficult to search older literature. McLellan (2001) quoted Douglas S. DeWitt from the University of Texas Medical Branch as stating that it would be easy to assume that MEDLINE encompassed the whole of medical literature.
The medical community’s reaction to the Johns Hopkins incident was openly critical. Bor and Pelton (2001a) quoted Dr. Frederick Wolff, professor emeritus at the George Washington School of Medicine, who accused Dr. Alkis Togias, the Johns Hopkins researcher, of being “foolish” and “lazy” (Bor’s quotes, ¶ 21). Wolff chastised the Johns Hopkins Review Board for failing to find articles from 1950 warning of the adverse reaction to hexamethonium, stating, “Anyone trained in academic medicine knows how to do this research. What happened is not just an indictment of one researcher, but of a system in which people don’t bother to research the literature anymore” (Bor & Pelton, 2001a, ¶ 22). The consequences for Johns Hopkins researchers were considerable. Bor and Pelton (2001b) reported that the Office for Human Research Protections (OHRP) suspended all Johns Hopkins research until a complete review could be made of active clinical trial contracts and the IRB review process.

In discussing the Johns Hopkins case, Gold (2003) speculated that IRBs could be held responsible because of their negligence in approving the flawed study design. She stated that an IRB in a case similar to the Johns Hopkins case was criticized for collecting insufficient information to review a research protocol at the University of Oklahoma, resulting in a study participant’s death. Gold argued that approving bodies have the responsibility to ensure that research protocols are ethically and scientifically sound.

The Johns Hopkins incident highlighted more than the importance of a thorough search of the literature. Discussion following the incident focused on the difficulty of finding all relevant literature, and the unfortunate consequences when the limitations of the sources searched were not understood. The implied liability for physicians and
members of IRB panels demonstrates the need not only to be able to search the literature, but also to interpret accurately what is found.

**Accrediting Bodies and Electronic Information Literacy**

In 1998, the AAMC released recommendations for medical informatics literacy in a report of the Medical School Objectives Project (MSOP). Strongly focused on traditional information literacy, this report listed five roles for physicians: life-long learner, clinician, educator/communicator, researcher, and manager. The MSOP report stated that an increasing number of incoming medical students were skilled in computer literacy. The report’s objectives were acknowledged as ambitious; as Kingsley and Kingsley (2009) noted, only a few programs have implemented even scaled back versions of the recommendations.

The Association for the Accreditation of Human Research Protection Programs (AAHRPP, 2005) is a non-profit organization that accredits institutions that conduct or review research involving human participants. Their charge is to protect research participants and to promote sound scientific research by delineating ethical and professional standards for persons and organizations that engage in research with human participants. AAHRPP standards define the membership and research review process of IRBs, including the expectation that individuals with the appropriate scientific or scholarly expertise review studies. However, these standards do not specifically mention the need for expertise in searching information resources.

Recognizing the importance of information search skills, the ACGME added a criterion to competencies for medical residency programs in 2008. Residency programs
are now required to offer training in “Practice-Based Learning and Improvement” as part of the learning process. Instructors are expected to teach residents to “investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices” (ACGME, 2008, p. 13). Although the ACGME suggests a structure for this requirement, it is up to the residents to demonstrate that they use information resources. The selection of these resources is left to the teaching physicians or other residents who may not be sophisticated users themselves.

In response to competency requirements, one institution offered its medical students training in information retrieval that went beyond teaching MEDLINE. Berner, McGowan, Hardin, Spooner, Raszka, and Berkow (2002) responded to information retrieval competency requirements prescribed by the MSOP report by developing a training program, which included not only MEDLINE skills, but also how to find and evaluate information on the Web. Students were taught to evaluate research articles and use the information to make recommendations for the treatment of patients. Training significantly improved the ability of students to perform these tasks; however, this study did not include the EMIPs, which are now ubiquitous in residency programs.

**Limitations of Commercial EMIP and EBM Resources**

EMIPs such as UpToDate, eMedicine, DynaMed, MDConsult, and others are highly competitive; each purports to be the most accurate and user-friendly. With the aggressive marketing of these products, with each claiming to be evidence based, one can understand the difficulties that physicians face when attempting to understand the services’ offerings. Each vendor claims its competitors do not update as frequently as
claimed, that authors show bias, that the editorial review process of competitors is less rigorous, and that the information produced is not researched thoroughly. Of course, no information product is perfect.

Researchers who hope to avoid the difficulties inherent in a rigorous MEDLINE search by relying on EMIPs may still find they need more in-depth search skills. Booth and O’Rourke (1999) cautioned that EMIPs should only be used for straightforward clinical questions. They advised that more complex inquiries require a good searcher to go to MEDLINE. Another option they suggested for clinical inquiries was quality filtered EBM products such as the Cochrane Library or the EBM journal, *Evidence-Based Medicine*. Booth and O’Rourke noted that although it has never been easier to find evidence, the search for that evidence “requires a greater awareness of both the advantages and the limitations of increasing numbers of resources” (p. 136).

Diringer (2003) also spoke to the need for a MEDLINE search when an EBM review does not exist or there is insufficient literature to establish a best practice. He emphasized that special needs cases, such as those in the intensive care unit, would require complex care. EBM and clinical practice guidelines are established from best practices drawn from multiple cases, but there will be many scenarios that lack established treatment standards in the literature. These scenarios will require physicians to step beyond the convenience of one-stop, full-text resources. The quality of EBM information may also vary, depending on the disease entity being searched, co-morbid conditions of the patient (Boyd et al. 2005; Wachter, 2006), or the unidentified bias of some studies used to create treatment guidelines (Mathews, 2005; Steinberg & Luce, 2005).
Physicians cannot rely solely on EBM in clinical settings. Ely, Osheroff, Ebell, Chambliss et al. (2002) analyzed data collected from an earlier study performed by Ely, Osheroff, Ebell, Bergus, Levy, and Chambliss (1999). In that study, 1,101 questions from 103 family doctors were used to identify obstacles to physicians using resources to answer questions during patient treatment. Two main categories encompassed the questions: first, available evidence was insufficient to answer the question, and second, when evidence was available, it was not always synthesized for quick application in a clinical setting.

Ely, Osheroff, Ebell, Chambliss et al. (2002) reported that the most significant problems for physicians when searching were (a) time constraints, (b) not finding the answer in the chosen resource, and (c) studies that were not synthesized into a clinically useful statement. Physicians often did not pursue information “because they doubted the existence of useful information in available resources” (p. 714). Ely, Osheroff, Ebell, Chambliss et al. suggested that for doctors to be able to find clinical information, they must be aware of their gaps in knowledge and then formulate the question in such a way that it can be addressed through available resources. They stated that physicians “need to pick the right resource the first time, the information in that resource needs to be readily found, and all the information must be there” (p.715).

In subsequent research, Ely, Osheroff, Chambliss et al. (2005) investigated the most frequent obstacles to using EBM in a clinical setting. They gathered data through observation and recorded interviews of 48 randomly selected generalist physicians during ambulatory care. The physicians were asked 1,062 questions, but only pursued answers to 585 (55%). The obstacle cited most often (52 questions, or 11%) was that the physicians
doubted that the answer existed in any resource. When physicians did pursue answers, the most common reason for failure was that the resource selected by the physician did not contain the answer.

Ely, Osheroff, Chambliss et al. (2005) cited Connelly, Rich, Curley, and Kelly (1990) who defined one obstacle to answering clinical questions as “the preference for the most convenient resource rather than the most appropriate one” (p. 218). Other obstacles included excessive time needed to find answers in existing resources, lack of access to information, difficulty searching the enormous amount of medical information, the inability to find a concise answer to a clinical question, and lack of evidence to answer a clinical question. Ely, Osheroff, Chambliss et al. found the most commonly used resource was a single textbook, followed by human consultation, desktop computer application (including the Web), and multiple textbooks. The most popular electronic resource used was an EMIP, UpToDate.

Investigating the efficacy of EMIPs, Koonce, Giuse, and Todd (2004) found that EMIPs could not answer 40% of the complex clinical questions and 30% of the general care questions. They concluded that EMIPs were better for answering general patient-care management questions than for complex clinical questions. Because the EMIPs did not answer 35% of the questions overall, they concluded that the ability to search the primary medical literature might still be necessary for answering patient care questions. Patel, Schardt, Sanders, and Keitz, (2006) compared MEDLINE to various EMIPs, which they referred to as “pre-appraised resources” (Cochrane Database, UpToDate, and ACP Journal Club). They found that while the pre-appraised sources were faster, they could
not answer all clinical questions, so it was still necessary to consult MEDLINE for many questions. Their conclusion was that physicians need both types of resources.

Koonce, Giuse, and Todd (2004) noted that EMIPs are becoming ubiquitous, and it is, therefore, imperative that information specialists be aware of the strengths and weaknesses of these resources. They warned, “users may discriminate among resources and ignore strengths and weaknesses in favor of convenience” (p. 410).

**Difficulties Creating Clinical Practice Guidelines and EBM Reviews**

Authors who create the clinical practice guidelines and standards from evidence-based research, which form the basis for EBM summaries, also need search skills. Steinberg and Luce (2005) identified scenarios that could affect the consistency of evidence, including patient preferences, the differing population across several studies, physicians’ judgment in a particular case, and illness severity of the population. Identifying these subtleties would require standards such as those established by the RTI-UNC Evidence-Based Practice Center (EPC) operated by Research Triangle Institute International at the University of North Carolina. The EPC comprehensively reviewed evidence-based studies and found that of the 121 evaluations used for rating quality of evidence; only 19 evaluations met the EPC’s standards.

The RTI-NC EPC has created standards for customized literature searches for research and meta-analysis (RTI International, 2006). Although the EPC has been awarded a five-year contract to assess EBM reviews for the U.S. Agency for Healthcare Research and Quality (2006) for their Evidence-based Practice and Preventive Services
sections, their stringent guidelines are not yet a standard in the EBM research community.

In addition to critical analysis of EBM, a skeptical appraisal of all medical information used to construct guidelines is necessary. Mathews (2005) reported on the inaccuracy of articles, describing the findings of drug trials published in major medical journals. She found that journals as reliable as the *Journal of the American Medical Association*, the *New England Journal of Medicine*, and *British Medical Journal* had published articles that omitted findings of harmful effects of trialed drugs. Although these journals have stringent requirements for authors, it can be difficult for journal editors to identify distorted data. In an effort to do so, the *British Medical Journal* is demanding that authors submit the original study design plans along with the article reporting study results. Other top journals are beginning to request original study designs, and the *Journal of the American Medical Association* occasionally has independent statisticians review results.

Mathews (2005) reported that medical journals have identified another concern; authors could cherry-pick results, looking for the most positive data while underplaying or omitting bad results. Mathews mentioned a *Journal of the American Medical Association* study, which found that 62% of trials had changed, added, or omitted at least one primary outcome to present positive rather than negative data.

Although pharmaceutical company representatives objected to the new, stricter rules researchers must now follow to publish findings, journal editors defended their decision (Mathews, 2005). Editors argued that the marketing potential of studies made it necessary to ensure the accuracy of the data presented. Prominent journals published
misleading data about trials of the painkillers Vioxx and Celebrex. This, in turn, led conscientious physicians to prescribe the drug because it was presented, at least initially, as an effective and safe medication. Matthews used the example of an article in the *Journal of the American Geriatrics Society*, which concluded that the drug Aricept was effective in delaying the onset of Alzheimer’s disease by as much as five years. After criticism from the *Journal of the American Geriatrics Society*’s readers that the study was flawed and misleading, Pfizer, the drug manufacturer, acknowledged the possibility of selection bias, although Pfizer did not think this negated their results. Under scrutiny, other researchers disagreed with the article reviewers’ conclusions, in one case stating that the FDA’s analysis that identified problems with their study used a different statistical analysis.

Mathews (2005) described the difficulty in identifying what caused the inaccuracies: the bias of authors, different approaches to the data, or the vast amount of data generated from studies that must be distilled into a journal article that presents findings. Mathews quoted Dr. Kamran Abasi, deputy editor of the *British Medical Journal*, as stating that one solution would be to publish the raw data. This article called attention to the complexity of drug study results and the difficulty of using study findings that cannot be guaranteed as accurate to develop EBM protocols.

**The Internet, the Web, and the Confusion that Surrounds Them**

Physicians also search the Internet, using Web search engines to find information. Cullen (2002) found that of the 294 physicians who responded to her questionnaire, 48.6% reported using the Internet to find clinical information. MEDLINE was the most
frequently identified Internet resource, but was identified by some as a database and by others as a Web search engine. Other medical sites also were listed incorrectly as search engines, illustrating the confusion that medical professionals experience when searching for information. Physicians, however, critically appraised what they used, checking the reputation of journals, using Web sites recommended by professional sources, and assessing the research methodology, sources cited, and the author’s credentials. Cullen recommended that physicians’ professional organizations and teaching institutions intervene to teach the distinctions among various electronic tools.

Carroll (2004) surveyed 4,062 international scientists regarding their satisfaction with Google and found that 65% in Asia Pacific countries; 50% in Europe, Middle East, and Africa; and 42% of scientists in the Americas agreed that Google satisfied their searching needs. Globally, 44% of researchers searching for information in medicine believed that Google satisfied their searching needs; however, Carroll did not elaborate on what the medical searches entailed. Age did not appear to make a difference in satisfaction with Google. Carroll did not describe how this population was selected so it is difficult to analyze these findings. One advantage for international scientists is that Web searches would provide more resources in their native languages.

Carroll’s (2004) report raises concerns when juxtaposed to Crocco, Villasis-Keever, and Jadad’s (2002) description of inaccuracies in information found on the Internet. Crocco et al. identified what they believed was the first case of information found on the Internet harming a patient. The information found on the Web by the patient’s parents corroborated the opinion of a physician on call and was used to treat a one-year-old boy with diarrhea. Over the course of one week, the boy’s condition
worsened. He was brought back to the hospital where the Web information was reviewed and found to be incorrect, and the treatment was changed. The authors cited McClung, Murray, and Heitlinger’s 1998 study, which showed that of the hundreds of Internet sites providing information for treatment of children with diarrhea, the majority, were inaccurate.

When Bennett et al. (2004) investigated Internet use, they found that physicians were overwhelmed by the amount of available information. Despite this, Bennett et al. reported that 46% of physicians used the Internet to access the latest research, 44.4% used it to access new information regarding a disease, and 43.7% used it to access information related to a specific patient problem. Unfortunately, Bennett et al. only generically identified the Internet resources that physicians were using (i.e., personal e-mail, literature searching, accessing online journals, etc). The first two authors identified their department affiliation as the Department of Continuing Medical Education, but it remains unclear how well they understood the Internet and what those broad categories might have contained.

While Taylor (2005) recommended that physicians use Web sites (p. 17), he failed to suggest how to identify quality sites. He stated that some of the best sites charged a fee, but presented this as an economic limit to use rather than explaining the differences between fee-based and free resources. He admonished the reader “not to be dependent on the expertise of a medical librarian” but gave no reason (p. 17). Since medical librarians are knowledgeable partners, he effectively discouraged the use of a free and easily available service provided by medical librarians: the filtering of enormous quantities of information and the identification of targeted, quality information.

Taylor’s (2005) searching expertise also is called into question by the amount of incorrect information found in his text. He referred to the search engine, Dogpatch\(^3\), instead of Dogpile.\(^4\) Dogpatch brings up a primitive Web page for Dogpatch, WA (sic). Dogpile is a meta-search engine that searches across several popular search engines such as Yahoo and Google. Taylor arbitrarily moved between two terms, PubMed and MEDLINE, without explaining that PubMed searches MEDLINE as well as several other government-funded databases. He presented PubMed and MEDLINE as separate resources and gave them separate Web addresses when they are both located at the PubMed site. He gave the URL for the NLM rather than MEDLINE. Naive users would not see a MEDLINE link, but, instead, a link for MEDLINEPlus, a consumer health database. PubMed was given incorrectly as a dot com rather than a dot gov, but http://www.pubmed.com still links to the correct site.

Taylor’s (2005) lack of comprehension of the complexity of the PubMed database is illustrated best by his description of MeSH. He referred to the medical subject headings

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\(^3\) [http://www.dogpatch.com](http://www.dogpatch.com)

\(^4\) [http://www.dogpile.com](http://www.dogpile.com)
as “the medical librarians’ full employment act” and stated that he does not use MeSH (p. 19). While one can empathize with Taylor’s frustration regarding the complexity of MeSH, his dismissal of this tool only served to give novice searchers the impression that MeSH does not perform a valuable function. In his favor, Taylor did provide clear descriptions of MDConsult and UpToDate, obviously understanding that they are review products and not the only resources one should consult.

What is particularly alarming is that this book was reviewed favorably in the *Journal of the American Medical Association*, one of the premier medical journals. Gotta (2005) described Taylor’s (2005) book as a “gem” and a “jewel” (p. 1142). He praised Taylor’s presentation of online research and helpful Web sites. Taylor’s book promulgates incorrect research information and enforces erroneous physician assumptions regarding electronic resources. A professional organization such as the AMA should have been capable of identifying physician reviewers who are sufficiently literate regarding electronic resources so that the book’s flaws would have been identified.

This kind of confusion over terminology can bewilder physicians as they try to select information resources. DeLeo, LeRouge, Ceriani, and Niederman (2006) found that physicians preferred to use specific sites, which they referred to as targeted sites, rather than Web search engines, such as Google. Favorite targeted sites were, in order of use, UpToDate, Medscape, WebMD, MDConsult, and eMedicine. DeLeo et al. described another group of physicians who indicated their preference was for research databases, and identified these as PubMed, Ovid, and MEDLINE. PubMed is a search site for MEDLINE, which also can be searched through other interfaces. Ovid is not a database,
but rather a database aggregator, so these users could also be searching MEDLINE. The confusion in the literature makes it difficult to find significant reports on research resource preferences and usage.

A search in MEDLINE using the term “Google” found 643 articles. A quick scan of the articles revealed that Google Scholar appeared in many of the abstracts as one of the tools used to perform a literature search, as, for example: “We searched electronic databases, including CENTRAL, MEDLINE, EMBASE, Google and Google Scholar for trials of antifibrinolytic drugs used in adults scheduled for cardiac surgery” (Henry, Carless, Fergusson, & Laupacis, 2009). It is unclear what CENTRAL is, unless they are referring to PubMed Central or Central Search, a federated search engine product that allows users to search across several databases at once. EMBASE is an appropriate database for pharmaceutical information.

Searching Google and Google Scholar is an effective way to perform a quick search or to double-check a more formal search to ensure that nothing has been missed. However, Google and Google Scholar are not databases and they do not identify themselves as such. This does not appear to be clear to the many researchers who identified them as databases in their abstracts. Confusion regarding the resources used to provide information for research reflects badly on the credibility of the information being reported. Researchers should be sufficiently literate to know what kinds of resources they are searching.
Information Literacy and Information Technology Fluency Initiatives

Literature focused on information-seeking behaviors of physicians demonstrates that physicians lack a global understanding of the information on which they depend (Bennett et al., 2004; Johns Hopkins University, 2001; Taylor, 2005). Although not a part of standard medical education, information literacy has been a priority for academic institutions since the ALA published its report on information literacy in 1989. The ALA defined information literacy as a set of abilities requiring individuals to “recognize when information is needed and [to] have the ability to locate, evaluate, and use effectively the needed information” (ALA, 1989). Using this definition, the ACRL (2000) created five standards for information literacy competency that could be used by institutions of higher education. These standards provided the basis for most work in information literacy in academia. They are defined as follows: The information literate student (a) defines and articulates the need for information; (b) accesses needed information effectively and efficiently; (c) evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system; (d) individually or as a member of a group, uses information effectively to accomplish a specific purpose; and (e) understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.

As academic institutions were rushing to embrace information literacy, Shapiro and Hughes (1996) wrote an editorial that challenged the liberal arts educational community to rethink curricula in terms of information. They argued that information literacy was a path to information independence where information seekers do not have to rely on those who have developed the systems for answers. They viewed information
literacy as a new liberal art and insisted that learning technical infrastructure was as important as learning the basics of liberal arts: grammar, logic, and rhetoric. Shapiro and Hughes suggested seven dimensions of literacy: (a) tool literacy, (b) resource literacy, (c) social-structural literacy, (d) research literacy, (e) publishing literacy, (f) emerging technology literacy, and (g) critical literacy. These dimensions emphasized the importance of technological literacy as well as expertise in finding and using information.

The U.S. National Research Council Committee on Information Technology Literacy (1999) set additional standards for what they referred to as technology fluency, described as an understanding of the underlying concepts of technology as it is used for problem solving and critical thinking. The NRC identified the core skill set as Fluency in Information Technology (FIT). They designated three broad categories necessary for FITness: (a) intellectual capabilities, (b) information technology concepts, and (c) information technology skills. FIT was described as integral to life-long learning as it allowed individuals to approach information creatively, to reformulate knowledge, and to synthesize new information. The NRC believed that to integrate FIT successfully into college and university curriculums, academic institutions would need to implement FIT on a program level and not simply as an addendum to a few courses.

Following that directive, the liberal arts program at Simmons College (2005) instituted a Fluency in Information Technology (FIT) program. The Simmons College administration agreed with the NRC (1999) that FIT supported life-long learning and that learning the foundations of information technology would allow one to acquire new skills independently after completion of a formal education. To follow information fluency competencies across the curriculum throughout the span of a student’s tenure at
Simmons, a rubric of established information fluency goals was compiled. Goals included computer and software literacy as well as the more global goals of information fluency.

Although information literacy has not yet been included in physician training, it has been integrated successfully into nursing programs. Skiba (2005) cited the work of Fox, Richter, and White (1989) who designed information literacy pathways for undergraduate nursing programs over 15 years ago, using the ALA definition of information literacy (1989). Other nursing programs used this definition and the ACRL (2000) standards as their starting point for developing information literacy instruction (Jacobs, Rosenfeld, & Haber, 2003; Shorten, Wallace, & Crookes, 2001).

Supporting the application of information literacy in health care, Pravikoff, Tanner, and Pierce (2005) stated that it was an essential ingredient for successful EBM in nursing. Using a random sample of 3,000 registered nurses across the United States, Pravikoff et al. administered a study using the five ACRL components of information literacy. Of the nurses responding, 37% were not able to integrate EBM into their clinical practice and had not been adequately prepared to search for information. The authors blamed lack of information literacy and computer skills and the undervaluation of research by nurses and their professional organizations. Pravikoff et al. urged registered nurse degree programs to instruct all students in information skills as preparation for EBM practice.

Shorten et al. (2001) developed an information literacy program that taught nursing students how to evaluate databases and instructed them in in-depth searching skills. Information literacy components were embedded into the curriculum as
recommended by the NRC (U.S. National Research Council, Committee on Information Technology Literacy, 1999). This program, however, focused on teaching traditional literature search skills. Jacobs, Rosenfeld et al. (2003) used the Shorten et al. curriculum-integrated approach for instruction on the broader scale of information literacy and information fluency. Information assignments were embedded into five courses and a Web-based tutorial for graduate nursing education.

Jacobs, Rosenfeld et al. (2003) observed that while end-user searching is common, nurses pursuing advanced practice degrees needed detailed instruction in medical information resources that would enrich their effectiveness as practitioners. They acknowledged, as had the NRC (U.S. National Research Council, Committee on Information Technology Literacy, 1999) the importance of information literacy for lifelong learning. Instead of using the standard approaches to literature searching, their instruction program was designed to teach information literacy at a sophisticated level, which involved comparing a variety of databases. Fee-based databases were compared to free Web search engines, and pharmaceutical Web sites were compared with e-textbooks and clinical databases. Meta-search engines and meta-sites were explained, as well as the concept of the invisible Web (i.e., information buried in databases or sites that would not be retrieved by Google or other Web search engines).

Information literacy and information fluency have, for the most part, been lacking in the training of physicians; instead, many nursing and medical schools and residency programs incorporated the problem-based learning (PBL) model. PBL allows a group of students to work together to solve a clinical problem with the help of an instructor (McMasters University, 2008). Although students worked with resources, the primary
focus was to solve a specific clinical problem, not learn broader information fluency skills.

In 1998, McGowan, Raszka, Light, Magrane, O’Malley, and Bertsch recognized the importance of including instruction in “the knowledge, skills and attitudes of information literacy and applied medical informatics” (p. 457) in medical schools as core competencies. McGowan, Raszka et al. believed that the growing field of medical informatics necessitated moving beyond the required MEDLINE class. They designed formal courses in information literacy and medical informatics, which were integrated into the University of Vermont Medical School’s four-year curriculum.

This approach was described as a vertical curriculum, and appears to be the same as the Jacobs, Rosenfeld et al. (2003) curriculum-integrated approach. McGowan, Raszka et al. (1998) evaluated information literacy and medical informatics knowledge as a component of each course. Feedback from graduates during exit interviews indicated that they felt prepared for future work in medical informatics. Graduates also testified that residency programs at which they interviewed did not offer the same infrastructure or level of commitment to medical informatics.

Attempts to embed EBM training into residency programs do not seem to have been as successful. Green (2000) surveyed 417 program directors of U.S. internal medicine residency programs to obtain details about EBM curricula, including objectives, format, curricular time, attendance, faculty development, resources, and evaluation. There was a 65% response rate. Of the 269 respondents, 99 (37%) offered a freestanding curriculum for EBM.
Green (2000) reported that most programs attempting to integrate EBM teaching into an established residency program did not appear to be meeting the need for information literacy in medicine because of the difficulty of integrating EBM into the clinical point-of-need setting. Grant and Brettle (2006) developed Web-based interactive information skills tutorials that were integrated into a program for master’s level and Ph.D. students in nursing, occupational therapists, and physiotherapists. Staff also attended the course. Tutorials taught search skills, including use of MeSH terms and basic Boolean searching in MEDLINE. Students evaluated the tutorials and 13 usable pre- and post-test assessments were gathered. All 13 students improved their core information-seeking skills. Web-based tutorials expanded the place and time for students to learn these skills and might address the time constraint issues mentioned in other articles. Grant and Brettle stated that the skills learned from this tutorial were generic and might translate to other resources.

Summary

The literature search revealed that lack of information literacy has had a direct effect on the delivery of quality health care (Braun et al. 2004; Johns Hopkins University, 2001; Ramsay, 2001). Evidence-based resources, touted as the solution to delivery of accurate and timely information to physicians, have not succeeded in that role. EBM and EMIP databases have not been incorporated fully into practice by busy clinicians (Alper, Stevermer et al., 2001; Braun et al., 2004; Covell et al., 1985; Ely, Osheroff, Chambliss et al., 2005; Slawson and Shaughnessy, 2005). In addition, there are inconsistent standards for the creation of EBM summaries and difficulties with the primary source
materials used to create clinical practice guidelines (Mathews, 2005; Steinberg & Luce, 2005).

A search of the literature found only one program for medical students that incorporated information literacy and information technology fluency (McGowan, Raszka, et al. 1998). This program began as part of a broader medical informatics initiative. Feedback received by graduates of the program, although self-reported, corroborated the dearth of information literacy support at the institutions where they performed their residencies. Some nursing programs have embedded information literacy instruction into their programs using a curriculum-integrated approach (Jacobs, Rosenfeld et al., 2003; Shorten et al., 2001).

The literature search also found no national standards or guidelines to provide direction for the development of classes to teach physicians information skills, although all accrediting organizations expected physicians to be information literate and familiar with electronic information resources (ACGME, 20081; AMA, 2005b; AAHRPP, 2005; U. S. National Academy of Sciences, Institute of Medicine, and Committee on Quality of Health Care in America, 1999).

Librarians’ traditional teaching methods are largely ineffective because elaborate search construction is not practical for most busy physicians (Alper, Stevermer et al., 2001; Braun et al., 2004; Covell et al., 1985; Ely, Osheroff, Chambliss et al. 2005; Slawson and Shaughnessy, 2005). Information instruction needs to move beyond an emphasis on search strategies to teaching the underlying concepts of technology used for problem solving and critical thinking (ACRL, 2000; McGowan, Raszka et al., 1998;

**Contribution to the Field of Study**

Drucker (1994) argued that CEOs should search for their own information. He implied that a computer-literate generation should translate into computer users who know how to pursue a topic exhaustively by searching across several resources. Given the availability of so many electronic resources, medical professionals searching for information are called upon to do this every day.

Information fluency skills are important at all phases of a physician’s career. Choudhry, Fletcher, and Soumerai (2005) noted that the longer physicians are in practice, the greater their need for quality improvement interventions. Their literature review analyzed studies that related length of time in practice or physician age to adherence to standards of appropriate diagnosis, screening, preventive health care, treatment, and health care outcomes of their patients. They concluded that because medical advances occur frequently, a physician’s tacit knowledge easily becomes outdated. Training in information literacy must aim at the information needs of physicians at every phase of their careers because without it, the consequences to patient care and research can be dire.

The results of this research helped to develop guidelines to design instruction for physicians in information literacy and information technology fluency. These guidelines address physicians’ information priorities and provide strategies that will enable instructors to expand physicians’ knowledge of information resources.
Chapter 3

Methodology

**Research Methods to be Employed**

Several studies have attempted to identify search behaviors of physicians (Bennett et al., 2004; Berner et al. 2002; Cullen, 2002; DaRosa et al., 1983; Haynes, McKibbon, Walker, Ryan et al., 1990). The literature review did not reveal any studies that scrutinized physicians’ understanding of the scope and limitations of the electronic resources they were using.

Although no study was found that matched the goal of this research, two studies examined the behavior of users of electronic resources. Wallingford, Selinger, and Humphreys (1988) (see Appendix B) and Peterson et al. (2004) (see Appendix C) used questionnaires that surveyed some of the behaviors that this research identified. A combination of portions of the two questionnaires allowed for the development of a new questionnaire (see Appendix D) that permitted the identification of resources ranked by user preference. The identified resources are linked to the information need the physician expected them to fulfill. The authors of these questionnaires granted this researcher permission to use their instruments for this research (see Appendixes E and F).

The Peterson et al. (2004) questionnaire investigated user preference of various electronic search engines and identified the commercial dominance of full-text EMIPs
over MEDLINE. This Peterson et al. study of EMIPs is cited throughout the user-preference literature and verified the popularity of EMIPs among medical students. The Peterson et al. Web questionnaire was administered exclusively to 116 medical students via WebSurveyor. Using components of this instrument was an effective method to corroborate that this preference extends to the medical community at large.

Wallingford, Selinger et al. (1988) studied how often physicians searched and what information needs they were attempting to meet. In an NLM sponsored study, Wallingford, Selinger, et al. used a paper-format questionnaire mailed to physicians who were registered to use MEDLINE through the NLM. Wallingford, Selinger et al. only surveyed health care professionals who searched MEDLINE through the NLM interface, GRATEFUL MED. Several of their questions targeted physician attitudes towards information, including satisfaction with their ability to search, the type of information they were seeking, and how much time they spent searching. Wallingford, Selinger et al. also correlated ages of the health care professionals to their search behaviors and preferences. Since Wallingford, Selinger et al. designed a portion of their questionnaire to be a simple demographic identification of physicians who use MEDLINE, these questions helped to identify demographics and information needs in this study.

Questions selected from Peterson’s et al. questionnaire were modified to apply to physicians who perform searches for other than clinical purposes, such as research or continuing education. Questions selected from Wallingford, Selinger et al. (1988) were modified to be more generic so that they did not exclusively address MEDLINE.

The author identified Adaptive Management Strategies, Inc. (AMS) as a solution to the problem of physician access. AMS is a privately held corporation founded in 2005
with offices in California and Connecticut. The company’s primary business is to provide proprietary consulting services to pharmaceutical and biotech companies. They gather candid feedback from physicians about pharmaceutical representatives and the message physicians perceive at the point of sale. Physician perceptions are analyzed to show correlation with various indices of sales effectiveness important to the client.

Secondarily, AMS conducts limited research on physician use of the Internet and various Web-based tools. Their client list is confidential but includes some of the largest pharmaceutical and biotech companies in the world.

AMS recruits physician participation primarily by e-mail. AMS is a certified user of AMA physician lists and their physician contact list is from the AMA opt-in CANSPAM-compliant certified email lists. AMS verifies that physicians who register have valid identification, including current medical licensure. AMS solicits confidential demographic information that can be used to allow statistically valid selections based on, for example, practice type or geographic location. Physicians are well known as low responders to surveys (Field, Cadoret, Brown, Ford, Greene, Hill, et al., 2002; Leece, Bhandari, Sprague, Swiontkowski, Schemitsch, Tornetta, et al., 2004; VanGeest, Johnson, & Welch, 2007). AMS guaranteed a valid response from a targeted population by physicians who had already indicated their willingness to participate in surveys by opting into the AMA’s program. The Nova Southeastern University IRB approved the proposed research methodology.

AMS considers physicians as independent contractors to AMS for their services; no participating physician is an AMS employee. Physicians are not required to maintain minimum levels of response, but can choose their level of involvement in AMS at any
time. AMS does not sell or endorse any products or services to its physicians and there is currently no advertising of any kind on its Web site (https://www.ams-pharma.com/Default.aspx). AMS does not sell, rent, or trade its physician registration data or lists to any third parties and provides results of surveys exclusively to the company who sponsors the research. AMS does not sell its physician feedback information or data to any entity.

Explanation of Questionnaire (see Appendix D)

AMS programmers formatted the questions below into a Web-based questionnaire.

Question 1:

How many times do you use the computer to search for medical information in the average month?

- □ 1-10
- □ 11-20
- □ 21-30
- □ 31-40
- □ >41
- □ I do not use the computer to search for medical information

If “I do not use…” was selected, a message was generated that stated: “The remainder of this questionnaire asks detailed questions about computers and information seeking behavior and will not be relevant to your interests. Thank you for your assistance.”

As this study used a random sample, there was no other method to determine if the selected physicians used computers to seek information. The survey confirmed that all the respondents used computers for information seeking. For the purpose of this study,
the response to this question helped to identify how heavily a physician relied on
electronic information. The information from questions #1 through #3 provided a basic
user profile showing frequency of computer use to search for information, satisfaction
with results, and perception of search expertise. This profile was compared with the
remainder of the questionnaire data.

*Question 2.*

Please rate your satisfaction with your search results:

<table>
<thead>
<tr>
<th>Not at all satisfied</th>
<th>Somewhat satisfied</th>
<th>Very Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

*Question 3.*

Please rate how experienced a user of online databases or electronic information
resources you consider yourself to be.

<table>
<thead>
<tr>
<th>Not at all experienced</th>
<th>Somewhat experienced</th>
<th>Very experienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Questions 2 and 3 have been investigated by other researchers. Satisfaction with
search results and perception of expertise are ordinarily high, despite mediocre search
results (Haynes, Johnston et al., 1993; McGowan & Berner, 2004; Slawson and
Shaughnessy, 2005; Wallingford, Humphreys et al., 1990).
**Question 4:**

Please rank the primary areas in which you search for information so that your most common area searched is #1, second most common is #2, third most common is #3, etc. Please rank at least three:

- [ ] Clinical questions
- [ ] Drug or medication questions
- [ ] Evidence-based medicine (EBM) reviews
- [ ] Continuing medical education (CME)
- [ ] Information to support your role as an instructor or medical school faculty
- [ ] Stay current in medicine
- [ ] Research (clinical trials, presentations, publication, etc.)
- [ ] Answers to other questions (specify)

The Web questionnaire required study participants to select at least three areas of need. Using if-then programming, the Web questionnaire automatically moved study participants to the topics they identified as information needs.

The information that study participants are seeking can influence which resources they find most desirable. Since it is the hypothesis of this study that physicians do not always select the appropriate resources to answer their information needs, this question permitted a comparison of physicians’ information needs to the resources they selected.
Questions 5 – 12:

You have indicated that you search for answers to type of information need selected in Question 4. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

_____ MEDLINE (through Ovid, PubMed, etc.)
_____ UpToDate
_____ eMedicine
_____ Medscape/WebMD
_____ MDConsult
_____ Micromedex
_____ ePocrates
_____ Paper resources (book, journal, etc.)
_____ Web search engines. Please specify:
      _____ Google
      _____ Yahoo
      _____ Other – Please specify:

_____ Other electronic resources. Please specify:

________________________________________________________
________________________________________________________

Questions 5 through 12 followed the same format for each subject area in which the participant listed as an area of interest in Question 4. Subjects were asked to rank which resources they would consult first and second. The Web questionnaire linked participants to the questions related to information needs they identified in Question 4.

The list of resources from which subjects could choose contained the core resources offered by many hospital libraries and the popular resources available for free or at a reasonable price to individuals. In addition, study participants could indicate any other resources they used.

a. MEDLINE (Ovid interface or through PubMed): The NLM database MEDLINE is the largest online medical information resource. All physicians have some exposure to Medline in medical school and their residencies. It searches approximately 16 million references from 5,000 journals, each of which has been
reviewed by the NLM Literature Selection Technical Review Committee for quality of content, as well as other features (U.S. National Library of Medicine, 2008). According to the Peterson et al. (2004) study, MEDLINE is not perceived as easy to use, which likely affects its popularity as a resource. MEDLINE is available free through PubMed or can be purchased by institutions through Ovid or other private sector providers.

b. UpToDate: Individual physicians and medical practices purchase this resource. Many hospital libraries also offer this resource for on-site use; remote access is too expensive for all but the largest libraries. UpToDate (2007) advertises this resource as targeting clinical issues. The information is physician-authored topic reviews. These are not true EBM reviews, as the conclusions are not drawn from a systematic review and meta-analysis of the literature. The authors synthesize and summarize the information and provide recommendations for treatment. This peer-reviewed resource is updated four times per year, but a topic may be updated earlier if a major development is identified. Consumer health resources are free. A drug database provided by Lexi-Comp is also included.

As of July 2009, individual new subscribers pay $495 the first year and then $395 yearly. A stand-alone CD-ROM product can be purchased for $1,500; a handheld device application is also available. Continuing medical education (CME) credits, which apply toward licensure renewal, are available only with personal subscriptions. UpToDate is marketed heavily to individual physicians. Annual subscriptions to hospitals and academic medical centers range from $45,000-$85,000 or more.
c. **eMedicine (offered free with advertisements and fee-based without advertisements):** eMedicine (2008) features topic reviews on clinical issues. These are not true EBM reviews, as the conclusions are not drawn from a systematic review and meta-analysis of the literature. It covers over 7,000 disorders with physician-authored, peer-reviewed topic reviews, consumer health information, patient education sheets, medical news headlines, recent journal updates, images, a PDA application, and recalls and alerts. Physicians can also receive CME credits at no extra charge if they register with the site. It is part of a publicly traded company that also owns Medscape/WebMD.

d. **Medscape/WebMD:** This product was called Medscape/WebMD when the questionnaire was designed. The portion that offers information to physicians is now called Medscape (2009), although the design has not changed. It offers free information to physicians including medical news releases, CME opportunities, specialty publications, and 125 full-text journals and textbooks. It is part of a publicly traded company that also owns eMedicine. Advertisements generate revenue. WebMD offers information to patients. For consistency, the resource is referred to as Medscape/WebMD throughout the text, and is updated when the results are presented in the result chapter.

    Medscape/WebMD also offers a MEDLINE interface. A physician who does not search MEDLINE regularly, however, might be unaware of the limitations of this MEDLINE interface. To test the effectiveness of this interface, a search was done on the term “hemochromatosis.” A Medscape/WebMD MEDLINE search of the term “hemachromatosis” (intentionally misspelled)
produced 20 articles. Spelled correctly, “hemochromatosis” retrieved 7,164 articles in Medscape/WebMD. Searching the misspelling “hemachromatosis” in PubMed, yielded 22 articles, but also triggered a prompt, “Did you mean: hemochromatosis (7,781 items)?” The MEDLINE search option in Medscape/WebMD can lead physicians to believe they have performed a PubMed search that includes alternative spellings. To retrieve the total number of results in Medscape/WebMD, a physician would have to realize that the term had been misspelled.

e. MDConsult: MDConsult (2007) offers 125 full-text journals, textbooks, weekly news, patient handouts, and clinical updates. A unique feature, “What patients are reading,” allows physicians to locate information patients might have read in the popular literature. It also covers the plots of television shows such as ER. Drug information produced by Gold Standard and authored by an editorial board is also included. Professional medical specialty organizations and health agencies of the federal government create these EBM practice guidelines. Physicians can also obtain CME credits from MDConsult. This resource costs institutions approximately $6,000. Individual subscriptions, as of July 2009, are available for $349 per year or $49 per month.

f. Micromedex: Micromedex (2010) is a high quality drug information resource, which includes European as well as U.S. uses for drugs. It also offers built-in drug calculators and patient education sheets in English and Spanish. Micromedex subscriptions are not offered to individuals. The yearly cost for institutions ranges from $30,000 - $50,000.

5 http://www.goldstandard.com/editorial_policy.html
g. ePocrates: ePocrates (2009) is a popular product for use with handheld devices that offers drug information, dosage tools, and an elementary diagnostic tool. It is not searchable via the Web. Cost for an annual individual subscription, as of July 2009, is approximately $195.

h. Paper resource (book, journal, etc.): Although this study is primarily interested in physicians’ use of electronic resources, paper resources were included as a possible choice. In Peterson’s et al. (2004) study, paper resources were rated significantly higher than MEDLINE and other electronic resources, implying they may still play a significant role in answering physicians’ questions.

i. Other Web search engines (Google (2009), Yahoo (2009), etc.) Please specify: With the advent of Google Scholar and the popularity of Google and other Web search engines, it is important to identify whether these search engines have been integrated into the medical community. This is a concern since medical information on the Web can be of questionable accuracy (Crocco et al., 2002). Cullen (2002) identified additional difficulties physicians experienced trying to understand what was available through the Web.

j. Other electronic resources. Please Specify: It was hoped that this category would reveal additional resources study participants use; additional resources used were not identified until physicians named them in the comments section of the questionnaire.
Questions 5.a – 12.a:

For the resource you ranked #1 for type of information needed selected in Question 4:

How long do you spend with the resource once you find the information?
- [ ] 1-5 minutes
- [ ] 6-15 minutes
- [ ] 16-30 minutes
- [ ] Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- [ ] 0-25%
- [ ] 26-50%
- [ ] 51-75%
- [ ] 76-100%

Questions 5.b. – 12.b:

For the resource you ranked #2 for type of information needed selected in Question 4:

How long do you spend with the resource once you find the information?
- [ ] 1-5 minutes
- [ ] 6-15 minutes
- [ ] 16-30 minutes
- [ ] Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- [ ] 0-25%
- [ ] 26-50%
- [ ] 51-75%
- [ ] 76-100%

After selecting the top two resources they would ordinarily choose to answer a question in a particular subject area, physicians were asked four questions about these two resources. In questions 5 through 11, physicians were asked to indicate (1) how much time they spent with the resource and (2) the percentage of time they located the information they sought. The Web questionnaire was coded so that the questions clearly would be connected to the resources they originally chose.
Research has indicated that time constraints directly affect physicians’ ability to perform searches at the point of care (Alper, Stevermer et al., 2001; Covell et al., 1985; Ely, Osheroff, Chambliss et al., 2005). Time constraints could also affect the selection of information resources. The amount of time spent with a resource was analyzed and compared with resource choice and perception of success. Physician satisfaction was gauged by how often they perceived they found the needed information.

Question 13.

How do you rate the overall usefulness of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not useful</th>
<th>Somewhat Useful</th>
<th>Very Useful</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>_______________________________</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>_______________________________</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>_______________________________</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
**Question 14.**

How do you rate the overall currency of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not current</th>
<th>Somewhat Current</th>
<th>Very current</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Other resources (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
**Question 15.**

How do you rate the overall thoroughness of information of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not thorough</th>
<th>Somewhat Thorough</th>
<th>Very thorough</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Other resources (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Question 16.

How do you rate the overall speed with which you find information in each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not Fast</th>
<th>Somewhat Fast</th>
<th>Very fast</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Other resources (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Questions 13-16 asked study participants were asked to rank each of the resources for perceived usefulness, currency, thoroughness, and speed. These responses were analyzed and compared with responses from:

- Questions 5 through 12: Resources ranked as first or second
- Questions 5.a through 12.a, and 5.b. through 12.b, length of time each resource was used and satisfaction with the resource.
**Question 17:**

Are you in a residency or fellowship program?

Peterson et al. (2004) found that medical students preferred UpToDate or MDConsult and that only 15% of students used MEDLINE even as a second-choice resource. The ACGME (2008) mandates that residency programs teach residents to find, critically review, and assimilate these findings into patients’ treatment plans. The information about residents and fellows was used to identify the information-seeking behaviors of this group. Age range alone does not identify students still in fellowship or residency.

**Question 18:**

Please check your age range:

- □ 20-30
- □ 31-40
- □ 41-50
- □ 51-60
- □ 61-70
- □ 71+

Wallingford, Selinger et al. (1988) used demographic data to identify where a physician was in the medical career continuum, and provided data that was compared with other factors to establish if age is an identifiable factor in methods of information seeking. Age has been discussed in the literature as a possible factor influencing physician care, particularly their willingness to find and apply recommended treatment guides and continue life-long learning efforts (Weinberger, Duffy, & Cassel, 2005).
**Question 19:**

Gender:

- [ ] Male
- [ ] Female

Gender as it might apply to physicians’ information-seeking behaviors in health care had not been investigated and so data was collected for this study.

**Question 20:**

Do you have access to a medical library?

- [ ] yes
- [ ] no

Access to a medical library could have expanded the number of resources available to physicians and thereby might have affected their choices.

**Comments:**

If you wish to share any additional comments regarding your information needs or this questionnaire they would be appreciated.

At the questionnaire’s end, participants added additional comments about the study (see Appendix J).

**Questionnaire Validation**

AMS made the questionnaire available on the Web as a test site. An expert panel of two medical library directors and one Associate Professor of Occupational Therapy in the Occupational Therapy Graduate Program at Quinnipiac University reviewed the proposed questionnaire. These professionals provided insights from their backgrounds in information resources from the perspectives of sophisticated library professionals and users of electronic resources. The panel was comprised of Daniel Dollar, MLS, Associate Director, Collection Development and Management, Cushing/Whitney Medical Library,
Expert Panel Comments

Overall, comments were very positive. One reviewer had reviewed the questionnaire in an earlier paper format and found the flow between questions to be challenging to follow. However, the reviewer believed the difficulties were resolved in the Web version by formatting that allowed links to take the user to the next appropriate question, rather than having to follow instructions to get there.

All reviewers reported that the survey was easy to understand. One reviewer suggested the addition of a “don’t use” or N/A button when subjects were questioned about their perceptions of specific databases (questions 13-16.) After considering this suggestion, the questionnaire was left as designed originally since the goal was to assess databases based on user perceptions, not usage per se.

A reviewer offered that the questionnaire was clear and organized, and this might lead to increased speed when answering questions. This reviewer did report that the instructions on the login page were unclear and a bit confusing and that it was necessary to click around on the page to find the survey link. This reviewer also shared:

“As a reader it would have been of interest to know the intent or goal or research question. The cursor blinks automatically on the first box which directed me as a reader to place a value in that box even if it was not my first choice. The length of the
survey was more than reasonable. The examples that were provided for clarification were good.”

**Feedback Results**

Feedback was shared with AMS staff who were particularly interested in the difficulty one reviewer experienced with the initial sign-on screen. As the other two expert reviewers and the five test subjects did not experience any of the problems described by this reviewer, the screen was left as designed originally. The design is also used successfully by AMS and is a format with which their subject group is familiar. Five volunteer physicians then pre-tested the questionnaire.

The original plan to test the questionnaire with physicians at the Lamar Souter Library at the University of Massachusetts Medical Center had to be abandoned. It was not possible to allow each physician access to the questionnaire in a heavily firewalled environment. Mr. Jon Jenett, the CEO of AMS, contacted via telephone, five physicians who were drawn randomly from the AMS subject pool and gave them access to the questionnaire. Subjects completed the questionnaire while on the telephone with Mr. Jenett, after which he read them the standardized validation questions (see Appendix G).
Responses to the Questionnaire Validation Pilot Study

1) Do you think that the time it took to complete this questionnaire was:
   a. Not too long
   b. Too long
   c. Just right

   ANSWERS: a=0  b=1  c=4

Comments:
   • “Once I figured out the methodology, it was easy to get through.”
   • “It took me about 11 minutes.”

2) Did you have any difficulty answering the questions?
   a. Yes
   b. No

   ANSWERS: a=0  b=5

Comments:
   • none
   • “Format was easy to figure out and it helped that my choice was repeated in the top of the question.”

3) Did you have any difficulty identifying your information needs (question #4)?
   a. Yes
   b. No

   ANSWERS: a=0  b=5

Comments: no comments

4) Did you have any difficulty recognizing or identifying the resource choices that applied to you?
   a. Yes
   b. No

   ANSWERS: a=1  b=4
Comments:

- “I thought you should have included specific drug company sites (like MerckMedicus, which I use a lot) but on reflection I can see why you didn’t include [it].”

5) Overall, how difficult or easy was it to complete the questionnaire, if ‘1’ is very easy and ‘5’ is very difficult?

ANSWERS:  
1=0  
2=4  
3=1  
4=0  
5=0

Comments:

- “Flowed nicely and was easy to follow.”
- “I will be very interested in the results, I know that I use the internet a lot.”
- “Imagine a PhD being done online! We are making progress.”

6) Final questions

Are there any additional comments you would like to make about the questionnaire?

Comments:

- “Very interesting”

Are there any suggestions you would like to make about the questionnaire?

Comments:

- “In the section where you ask to rate usefulness, speed, etc. of the various options, I would suggest you make it more clear in the heading what is the main attribute being evaluated (like speed).”

Are there any questions about the study that I can answer for you?

Comments:

- “Would like to see results”
- “Keep me posted – very interesting and will be good to track over time to see changes.”
Having received positive feedback from the five test physicians, AMS and the researcher believed it was appropriate to proceed with the survey as designed.

**Research Analysis Plan**

The questionnaire allowed for comparisons among various responses. These included: frequency of information use, age, gender, resource preferences, frequency of use, user satisfaction with search skills, user self-assessment of search skills, primary areas for which physicians seek information, primary and secondary resources for the information being sought, how often these resources are used, and overall ratings on the usefulness, currency, thoroughness, and speed of all of the resources at their disposal.

The collected data identified physician assumptions, preferences, and knowledge of which resources provide the most accurate information for a particular medical scenario. This information formed the basis for the construction of information literacy guidelines. These guidelines target the global issues of physician information-seeking behaviors and physician information needs. New information resources and new interfaces will continue to be developed and marketed to the medical community. These guidelines will allow teaching institutions and professional organizations to provide physicians with the baseline knowledge they need to adopt a more sophisticated approach to information technology and to adapt more easily to new information technologies.

**Distribution of Questionnaire**

AMS created a VPN-secure Web page and made the questionnaire available on their server from August 21, 2008 to September 1, 2008. This researcher paid a fee to
AMS to cover the cost of creating and hosting the Web-based questionnaire on their server and of e-mailing the questionnaire in order to blind the physician sample from this researcher. The researcher’s identification and motive for the research (to obtain a Ph.D.) was revealed to the subjects to inform them of the use of their responses. Each physician who participated in the study received $75, the standard compensation from AMS for a survey of this type. This incentive was only to encourage answers to the questionnaire and did not reward a particular response. The incentive was identical to the incentive AMS pays its subjects, so the payment should not have affected physician response. The random sample delivered ranged across age groups and gender and targeted the geographic location identified by this researcher.

Family practice physicians in Connecticut were selected from the AMS database using a random number generator. AMS made contact via e-mail, using their standard e-mail format (see Appendix H) and their standard questionnaire format (see Appendix I), so that the questionnaire would not appear different from other questionnaires the physicians had received from AMS. AMS also requested that demographic questions be asked at the end of the survey to be consistent with their format. Information identifying this researcher and the purpose for the study was incorporated into the AMS e-mail that also included their standard assurance of confidentiality. Physicians were sent an e-mail requesting that they respond to the survey. Those who agreed to participate were sent a link to the Web questionnaire. No additional follow-up mailing was necessary.
Probability Sampling and Random Selection

AMS randomly sampled 200 from a population of approximately 480 family practice physicians in Connecticut. This resulted in a confidence level of 95% and a confidence interval of 5.27. AMS guaranteed a response of 70-75 physicians and delivered 90 responses for a response rate of 45%. This researcher followed AMS’s research protocol, which met the requirements of Nova Southeastern University’s IRB. AMS randomly select physicians for their contracted research to avoid selection bias. They are not told in advance what the project is and the client is not identified. Projects on the AMS site typically are identified blindly as “Project #070402.” In the case of research projects, AMS does not provide any identifiers or names of research leaders or sponsors unless there is a valid scientific reason to do so. However, if physicians are being solicited for a survey (rather than interactive feedback sessions with client representatives), the physicians are advised in advance of the format for the project. For this research, physicians were informed that the questionnaire responses were for the completion of a Ph.D. at Nova Southeastern University.

Reliability and Validity

The use of AMS as the Web-based survey distributor allowed this research to be presented by a reputable organization using an established professional format. The contact information from the AMA-generated list ensured a reliable sample. Physicians opt in to this electronic survey program, so only physicians comfortable with at least some level of technology received the survey. This will eliminate physician responses, or
lack of responses, due to disinterest or lack of comfort with computers by the nature of the survey delivery via e-mail link and Web-administered questionnaire.

**Data Analysis**

Options for statistical data analysis were limited by the questionnaire design. A statistician was consulted to ascertain if the response numbers offered a large enough sample to allow for the application of statistical formulae. Statistical analysis was done for the initial description of the population as described in the first four questions as the subject group was large enough. The data illustrating the use of resources and physicians’ perceptions are presented in a series of figures and tables, using percentages to describe significant trends found in the data.

**Summary**

Understanding the new electronically formatted information is increasingly important in medicine. As more professional organizations mandate the knowledge and use of clinical practice guidelines, EBM, and electronic resources, physicians need to sort through the ever-growing number of information resources to find the most reliable answers. Using the questionnaire described in this proposal (see Appendix D), physician needs and perceptions have been incorporated into the development of information literacy and information fluency guidelines (see Appendix J).
Chapter 4

Results

Introduction

Using the methodology described in Chapter 3, this research tested the following hypotheses:

1. Physicians perceive all electronic resources as being equally current and thorough.
2. Physicians think each resource has the same level of functionality.
3. Physicians are satisfied with the results of their research whether or not they have used the most effective resource.

Description of Presentation of Data

The data as presented in this chapter follows the plan of analysis in Chapter 3. The demographics are described and compared to identify correlations among age, gender, designation as residency or practicing physician, access to a medical library, self-perception of experience using electronic resources, and satisfaction with search results.

These results were correlated with subject areas and the resources used to find information for these subjects. Resource selection was compared to the subject areas and assessed for appropriateness of resource selection. Time spent with each resource was compared to satisfaction with search results for each subject. These results were
compared to the preference ranking of the resources to establish if the most successful results were achieved with the resources that were used most frequently. This information then was compared with the initial rating the physicians provided at the beginning of the questionnaire regarding their self-perceived expertise and success with information searching.

Finally, physicians rated each resource independently for perceived usefulness, currency, thoroughness, and speed, and the ratings were compared to resource selection when applied to specific subject areas. User perception of success with each resource when searching a particular subject and the length of time spent with each resource was compared to the ratings given to each resource independent of a subject area. Results of the hypotheses are discussed.

Sample Population Description

Of the population of 480 family practice physicians, 358 (75%) were males, and 122 (25%) were females. A random sample of 200 resulted in a response of the 90 physicians; 68 (76%) were males and 22 (24%) were females. This response was representative of the larger population for family practice physicians in Connecticut. Five of the 90 respondents were in a residency program—four males between the ages of 20-30 and one female in the 41-50 age range. Residents are often compelled to do literature searches as part of their training, but there were no differences between information seeking behaviors of residents and physicians. For this reason, they are included as part of the physician population. Of the 90 physicians surveyed, 81 (88%) stated they had access to a medical library. The majority of males were 31-40, slightly younger than
females, differing by 1%. The overall majority was between the ages of 41-50 (see Table 1), an age group probably not as familiar with electronic resources as younger physicians.

Table 1

*Age of Study Participants*

<table>
<thead>
<tr>
<th>Age</th>
<th>Male</th>
<th>Female</th>
<th>All</th>
<th>% Male</th>
<th>% Female</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>6%</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>31-40</td>
<td>18</td>
<td>8</td>
<td>26</td>
<td>26%</td>
<td>36%</td>
<td>29%</td>
</tr>
<tr>
<td>41-50</td>
<td>24</td>
<td>9</td>
<td>33</td>
<td>35%</td>
<td>41%</td>
<td>37%</td>
</tr>
<tr>
<td>51-60</td>
<td>17</td>
<td>2</td>
<td>19</td>
<td>25%</td>
<td>9%</td>
<td>21%</td>
</tr>
<tr>
<td>61-70</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>6%</td>
<td>14%</td>
<td>8%</td>
</tr>
<tr>
<td>71+</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>22</td>
<td>90</td>
<td>76%</td>
<td>24%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Findings**

**Physician Self-Perceptions of Information Seeking**

Physicians were asked to indicate how many times they searched for medical information via computer in the average month, how satisfied they were with their search results, and how experienced they considered themselves to be in searching electronic information resources. These three questions were used to establish how much the
physicians relied on electronic information to answer questions in their practice and how satisfied and confident they were with their research skills.

The number of times the physician searched for information was compared with the age and gender of the subjects. This data supports no significant gender differences on computer usage. A weighted average based on the midpoint for each range revealed that, on average, males and females searched almost equal amounts, with males searching an average 29 times per month and females, 27 times per month (see Table 2).

Table 2

*Average Times Subjects Used the Computer to Search for Medical Information in One Month by Gender*

<table>
<thead>
<tr>
<th>Times Used</th>
<th>Male</th>
<th>Female</th>
<th>All</th>
<th>% Male</th>
<th>% Female</th>
<th>% all</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-10</td>
<td>10</td>
<td>3</td>
<td>13</td>
<td>15%</td>
<td>14%</td>
<td>14%</td>
</tr>
<tr>
<td>11-20</td>
<td>17</td>
<td>4</td>
<td>21</td>
<td>25%</td>
<td>18%</td>
<td>23%</td>
</tr>
<tr>
<td>21-30</td>
<td>11</td>
<td>7</td>
<td>18</td>
<td>16%</td>
<td>32%</td>
<td>20%</td>
</tr>
<tr>
<td>31-40</td>
<td>9</td>
<td>4</td>
<td>13</td>
<td>13%</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>&gt;40</td>
<td>21</td>
<td>4</td>
<td>25</td>
<td>31%</td>
<td>18%</td>
<td>28%</td>
</tr>
<tr>
<td>Do not use</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>22</td>
<td>90</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

| Weighted Average/month | 29 | 27 | 28 |
To investigate the hypothesis statement that physicians are satisfied with the results of their research, whether or not they have used the most effective resource, it was important to establish other possible influences on satisfaction. Physicians who searched 31 or more times per month (n=38) had a significantly higher level of satisfaction with their results (p. <0001) than physicians who searched 21-30 times per month (n=18) or 1-20 times per month (n=34).

Physicians’ perceptions of their expertise in using electronic resources were compared to establish if this affected their overall satisfaction with their search results. When comparing the data, however, there was no significant variation between perception of expertise and satisfaction with search results, with only a 4% difference between those who rated themselves as somewhat satisfied with search results and those who perceived themselves as somewhat experienced as users. There was only a 5% difference between those who rated themselves as very satisfied with their results and perceived themselves as very experienced searchers. (see Tables 3 and 4).

Table 3

*Self-Perceived Satisfaction with Search Results Overall by Gender*

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Male</th>
<th>Female</th>
<th>% Male</th>
<th>% Female</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>37</td>
<td>13</td>
<td>50</td>
<td>54%</td>
<td>59%</td>
<td>56%</td>
</tr>
<tr>
<td>Very</td>
<td>30</td>
<td>9</td>
<td>39</td>
<td>44%</td>
<td>41%</td>
<td>43%</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>22</td>
<td>90</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 4

*Self-Perception as Experienced User of Online Databases or Electronic Information Resources*

<table>
<thead>
<tr>
<th>All</th>
<th>Male</th>
<th>Female</th>
<th>All</th>
<th>% Male</th>
<th>% Female</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>3%</td>
<td>0%</td>
<td>2%</td>
</tr>
<tr>
<td>Somewhat</td>
<td>40</td>
<td>14</td>
<td>54</td>
<td>59%</td>
<td>64%</td>
<td>60%</td>
</tr>
<tr>
<td>Very</td>
<td>26</td>
<td>8</td>
<td>34</td>
<td>38%</td>
<td>36%</td>
<td>38%</td>
</tr>
<tr>
<td>Total</td>
<td>68</td>
<td>22</td>
<td>90</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The 56% who indicated they were only somewhat satisfied with their search results conflicts with the higher level of satisfaction reported in the literature (Haynes, Johnston et al., 1993; McKibbon & Walker-Dilks, 1995; Wallingford, Humphreys, et al., 1990). This may be due, in part, to older studies reflecting physicians’ confidence in their searching abilities before so many additional resources competed for their attention. In the newer studies, many subject groups were comprised of residents, and these subjects generally reported being more confident in their computer abilities (McGowan & Berner, 2004; Peterson, Rowat, Kreiter & Mandel, 2004).

Differences in age presented significant differences in search satisfaction. Physicians 51 years or older were significantly less likely than physicians aged 41-50 to rate satisfaction as high (p=0.0373). Although physicians aged 21-40 were more likely than those aged 41-50 to rate their satisfaction as high, it was not significant (p= 0.7901).
Males were slightly more likely to rate their search satisfaction as high, but it was not statistically significant (p=0.7918). The data suggests that age plays some part in satisfaction with search results, with older users who may be less comfortable with the technology rating themselves as the least satisfied with their search results (see Table 3).

**Ranking of Subject Areas**

To address the three hypotheses, first the analysis required physicians to identify the areas of primary interest for which they searched for information. Physicians’ areas of interest are presented in Figure 1 by first, second, and third subject areas.

The predominant area chosen for first area of interest was staying current (see Figure 2). This desire may be due to the continuous growth of medical information as reported in the literature (Alper, Hand, et al., 2004). The second largest area of interest was CME, which logically follows the interest in staying current as continuing medical education supports this goal. More importantly, CME credits are necessary to retain a license to practice. Five of the subjects were residents and would not be pursing CME, which means that, in fact, 24% of eligible physicians overall were interested in CME.

The subject selected fourth was clinical. This may be due to the lack of time to search for information during the patient visit or to follow up on questions after the patient visit (Ely, Osheroff, Ebell, Chambliss, Vinson, Stevermer et al., 2002). It is also possible that the subject, drug or medication questions, was selected third because medication questions can be a common clinical question during a patient visit. The low number of physicians interested in searching for information to support teaching roles or
to perform research implies that family practice predominantly involves concentration in direct patient care.

![Figure 1](image)

*Figure 1.* Physician ranking of reasons for information searching.

Although 18% of physicians were interested in answering clinical questions, only 4% of physicians overall, reported EBM as an area of interest, rating it the least important area of interest in the subject areas. Family practice involves treating patients of all ages, diagnosing and treating a full range of medical problems and would logically benefit from the established treatment protocols that EBM offers.
Figure 2. Physician top three subject-area search choices.

The comparison of subject area selection between 22 females and 68 males displayed almost identical concentrations of interest (see Figure 3). Choices differed at most 7% between males and females (see Table 5). As the results for females were generated from an n=22 for resource choices it was difficult to identify strong trends. After examining the more detailed choices for first, second, and third choice it was determined that the variations in choices was too small to be meaningful as the data analysis became more in depth and then numbers for both genders became smaller.
Figure 3. Times, by gender, each subject choice was selected first, second, and third.

Table 5

**Total Choices of Subject Areas by Gender**

<table>
<thead>
<tr>
<th></th>
<th>Male</th>
<th>Female</th>
<th>All</th>
<th>% Male</th>
<th>% Female</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical</td>
<td>32</td>
<td>10</td>
<td>42</td>
<td>16%</td>
<td>15%</td>
<td>16%</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>33</td>
<td>15</td>
<td>48</td>
<td>16%</td>
<td>23%</td>
<td>18%</td>
</tr>
<tr>
<td>EBM</td>
<td>8</td>
<td>2</td>
<td>10</td>
<td>4%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>CME</td>
<td>46</td>
<td>14</td>
<td>60</td>
<td>22%</td>
<td>21%</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>All</td>
<td>% Male</td>
<td>% Female</td>
<td>% All</td>
</tr>
<tr>
<td>------------------</td>
<td>------</td>
<td>--------</td>
<td>-----</td>
<td>--------</td>
<td>----------</td>
<td>-------</td>
</tr>
<tr>
<td>Support role</td>
<td>18</td>
<td>2</td>
<td>20</td>
<td>9%</td>
<td>3%</td>
<td>7%</td>
</tr>
<tr>
<td>Stay current</td>
<td>57</td>
<td>21</td>
<td>78</td>
<td>28%</td>
<td>32%</td>
<td>29%</td>
</tr>
<tr>
<td>Research</td>
<td>10</td>
<td>2</td>
<td>12</td>
<td>5%</td>
<td>3%</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>204</td>
<td>66</td>
<td>270</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Overview of Resource Selection**

To investigate the hypotheses regarding physicians’ perceptions of resources, ninety physicians were asked to select a resource for three subject areas, resulting in 270 choices to be analyzed for each resource. They could choose two resources for each subject area, resulting in 540 total choices. Physicians could select from ten choices: MEDLINE, UpToDate, eMedicine, Medscape, MDConsult, Micromedex, ePocrates, paper resources, Web search engines (Google, Yahoo, etc.), or they could specify other electronic resources. In short, there were 270 choices to be analyzed for each resource and 540 choices overall (see Figures 4-6).

Figure 4 illustrates which resources were selected first for the three subject areas physicians searched. Figure 5 indicates which resources were selected second. Resources selected first were compared with resources selected second to establish where physicians searched if they needed more information or were not satisfied with their first choice. When reviewing the changes from first choice to second choice, Figure 6 indicates that UpToDate lost 15%, and the other EMIPs overall gained percentage points in the shift.
with eMedicine gaining 5%, MDConsult gaining 2% and Medscape gaining the most, at 7%. MEDLINE, Micromedex, and ePocrates all had small decreases. It would appear that if UpToDate did not provide the information sought, physicians would choose another EMIP.

![Pie chart](image)

*Figure 4.* Times each resource was selected as first preferred.
The only non-EMIP resource to gain position between first and second choice was paper by 6%. Paper, as first choice, rated higher overall than eMedicine, MDConsult, ePocrates, Google, and Yahoo. As second choice, paper tied with MEDLINE and was preferred over eMedicine, MDConsult, Micromedex, ePocrates, Google, and Yahoo. Paper’s popularity may be attributable in part to the age of the sample group, with only four physicians between the ages of 20 and 30. The first and second choices were analyzed further as each subject areas resource choices were scrutinized.
Figure 6. Times each resource was selected overall to find information.

The most popular resource overall was UpToDate, selected far ahead of the second most popular resource, Medscape, and MEDLINE, third most popular (see Figure 6). The popularity of UpToDate is well documented in the literature (Peterson, Rowat, Kreiter, & Mandel, 2004; DeZee, Durning, & Denton, 2005; Ely, Osheroff, Chambliss, Ebell, & Rosenbaum, 2005; Peterson et al., 2004; Schilling, Steiner, Lundahl, & Anderson, 2005). These numbers corroborate that popularity. More than half of the physicians chose EMIPs as their first or second resource choices, with 145 (54%) choosing EMIPs for first choice and 144 (53%) for second choice.
The complexity of analyzing the physicians’ selections after the granular breakdown into first, second, and third choice was not pursued as the data at this level of detail did not offer strong results. However, combining the choices allowed for a larger representation of how resources were perceived. For this reason, choices one, two, and three were combined for the analysis. In addition, investigation by gender of all areas would have reduced results to numbers too small to generate accurate conclusions, and there did not appear to be any outstanding differences for subject area (see Table 5) or resource preference (see Figure 7 and Table 6) so the data were combined.

When resource choices were reviewed by gender (see Figure 7). The small numbers of females in each category did not allow for any identification of strong preference for resources by gender. There is a slight preference for UpToDate by females, and Micromedex and paper resources were chosen more often by males (see Table 6). Although there were some differences in resources chosen by gender, these variations might be ascribed, in part, to the variation in age range, with 22 (30%) males between the ages of 51-71+ and 23% of females in that age range (see Table 1).

Physicians did not name other resources when they were queried for additional resources in the “other” category. They did, however, name other resources in the comments section. After the survey, at the researcher’s request, AMS, the survey group, called four other volunteer physicians to test this question to identify possible reasons for the omission of this information. Each physician stated that although they might use other resources, they believed the most prominent resources had been identified so they did not feel the need to add further resources.
Figure 7. Times each resource was selected overall by gender.
Table 6

*Total Number of Times Each Resource was Selected by Gender*

<table>
<thead>
<tr>
<th>Resource</th>
<th>Male</th>
<th>Female</th>
<th>All</th>
<th>% Male</th>
<th>% Female</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>57</td>
<td>22</td>
<td>79</td>
<td>14%</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>119</td>
<td>46</td>
<td>165</td>
<td>29%</td>
<td>35%</td>
<td>31%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>18</td>
<td>5</td>
<td>23</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Medscape</td>
<td>67</td>
<td>24</td>
<td>91</td>
<td>16%</td>
<td>18%</td>
<td>17%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>2%</td>
<td>2%</td>
<td>2%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>62</td>
<td>11</td>
<td>73</td>
<td>15%</td>
<td>8%</td>
<td>13%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>15</td>
<td>6</td>
<td>21</td>
<td>4%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Paper</td>
<td>50</td>
<td>10</td>
<td>60</td>
<td>12%</td>
<td>8%</td>
<td>11%</td>
</tr>
<tr>
<td>Google</td>
<td>12</td>
<td>5</td>
<td>17</td>
<td>3%</td>
<td>4%</td>
<td>3%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>408</td>
<td>132</td>
<td>540</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Comparison of Subject Areas to Resources Chosen**

For each area of interest, selections for first or second resource choices were checked to gauge the appropriateness of the resource used for that area of interest.

Analysis of the percentages allowed for informed speculation on search behaviors.

Figures 8 through 18 present the resources chosen to answer questions in each subject
area. Subject areas are presented in order of most to least often selected, and resources choices for each area are discussed. Resource choices were judged based on the capabilities of each resource, and that resource’s ability to answer most comprehensively questions in the subject area selected. This comparison was used to ascertain physicians’ abilities to choose the resource that best met their information needs. The features of these resources have benefits and limitations that dictate their effectiveness in finding information in certain subject areas. Based on a resource’s capabilities, choices for each area were rated as ineffective, partially effective, or effective.

Resources were rated ineffective if the resource was either not capable of supplying needed information or searching for the information was too time intensive to be practical. Partially effective resources were those resources that could supply some of the information in a timely fashion but required additional searching to ensure information complete enough to supply an accurate answer. Effective resources were those that offered complete information for the subject selected, although other resources could appropriately augment that information.

**Resource Choice Discussion: Stay current in medicine**

Staying current was by far the largest area of interest, with 78 of 90 (86%) choosing it as one of their topics overall. Staying current is a challenge exacerbated by information glut and physicians’ time constraints. Although all resources have some information of value to staying current, some resources are more efficient and complete than others. While Figure 8 shows the resources physicians went to first, and then second, Figure 9 illustrates the usage of resources overall.
Figure 8. Times each resource was selected first and second for staying current.

**Ineffective Resources:**

Choices for staying current were problematic. As seen in Figure 8, UpToDate was the overwhelming first choice to satisfy this purpose, and the preferred choice overall (see Figure 9). UpToDate, an online textbook, is an ineffective resource for staying current with information because it is updated only four times per year. If UpToDate judges a development to be of critical importance, it would contact the authors to update their topic review. The authors would re-write their review and submit it to UpToDate, where it would be reviewed and then published. New information deemed not critical
would only be added if it were identified by one of the authors and included in the next rewrite of the topic review. This turn-around time is too slow to meet the needs of staying current. In addition, the format is not conducive to finding new information as the front page consists of a search box with no additional information, giving it the same, simple interface as Google. Other resources have menus that offer various ways to access the information, such as by disease, new treatment announcements, or news feeds from medical journals.

Figure 9. Total resource choices for staying current.
Micromedex, a drug information resource, was selected by 23 overall (15%). It is highly reliable for drug research, but a physician would have to search particular drugs to locate updates or warnings or to find if information had changed. The PDA application, ePocrates, chosen by five (3%) is designed to provide drug information in clinical situations via a handheld device. For that reason, it is not an effective tool for staying current. It is possible that physicians rely on the online feature of ePocrates to provide timely, updated information on drugs; but this would only allow a physician to stay current on a medication for which a search had been performed.

The home page for eMedicine, chosen by seven (4%), is designed to be a clinical resource and would not provide information for staying current. Google, selected by four (3%), does not present the most current results first; so, unless physicians know specifically what topic to search, they will not find current information. Results in Google and Google Scholar are not consistently or sufficiently comprehensive for medical purposes because they are not searched via a thesaurus such as MeSH. Yahoo was not selected.

*Partially Effective Resources:*

Medscape and MDConsult, selected by 14%, are user-friendly, and have updated information prominently displayed on their home pages. New information is presented in a news format, but only the information from well-known publications is presented. Less interesting, specialty-specific topics, or research presented in smaller specialty or professional organization publications could be missed. EMIPs with news alert features are, however, still a stronger selection than UpToDate.
Eighteen, or 12% of physicians, selected a paper resource, the same number who selected the popular resource, Medscape. The newest developments in medicine are published in journals, and browsing tables of contents has been the classic way physicians stayed current. As mentioned by Alper, Hand, Elliott, Kinkade, Hauan, Onion, et al. (2004) the plethora of journals makes this a challenging endeavor. RSS feeds from some electronic journals provide tables of contents as the journals are published, making this task easier and more efficient. For this resource to be completely effective, it would need augmentation with an electronic component. Most journals have an electronic version and offer RSS feeds; a resource that is only paper is unusual. The electronic component would make paper resources an effective choice. It is possible that, although the physicians chose paper as their resource, they were limited by the lack of choice for RSS feed in the questionnaire.

*Effective Resources:*

The most reliable source for current developments in a specialty is MEDLINE. A literature search in an area of interest will yield the most current information. MEDLINE posts citations through PubMed as soon as they are received from publishers, who transmit the data to the NLM before they release the journal. If a physician wishes to stay current in an area of interest, a search can be constructed and saved in PubMed’s MyNCBI. PubMed will automatically run the search at the frequency requested and send an automatic update of new citations directly to the physician’s e-mail account. This service is free.

There is also a link on PubMed’s home page to citations recently added to PubMed and an RSS feed for several categories of information. Since MEDLINE often
receives a publisher’s information before the journal is released in print, this would make paper, selected by 18 (12% overall), a less current resource even if the physician is reviewing the most current paper journals.

**Summary—Resource Selection: Staying Current**

In summary, 69% of the responding physicians selected an ineffective resource for their first choice and 61% of the physicians overall selected an ineffective resource for the purpose of staying current (see Figure 10). With only 14% selecting MEDLINE, it is apparent that physicians do not understand the capabilities of this resource.

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>UpToDate (35%)</td>
<td>Medscape (12%)</td>
<td>MEDLINE (14%)</td>
</tr>
<tr>
<td>eMedicine (4%)</td>
<td>MDConsult (2%)</td>
<td></td>
</tr>
<tr>
<td>Micromedex (15%)</td>
<td>Paper (12%)</td>
<td></td>
</tr>
<tr>
<td>ePocrates (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google (3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yahoo (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>60%</strong></td>
<td><strong>26%</strong></td>
</tr>
</tbody>
</table>

*Figure 10. Efficacy of resources for staying current.*

**Resource Choice Discussion: Continuing Medical Education (CME)**

The Accreditation Council for Continuing Medical Education (ACCME) regulates CME credits. Physicians must obtain credits to maintain their license to practice. This number can vary, but many states require physicians to earn between 50 and 100 CME
credits per year. Figure 11 shows first and second choices for CME, and Figure 12 shows choices one and two combined.

![Bar chart](chart.png)

**Figure 11.** Times each resource was selected first and second for CME.

**Ineffective Resources:**

MEDLINE, Micromedex, Google, and Yahoo were selected by 27 or 23% overall. None of these resources provides CME credits, so it is unclear why physicians would choose them.
**Partially Effective Resources:**

In this subject area, partially effective resources are not an option. Either a resource offers CME credits or it does not.

![Pie chart showing resource choices for CME](image)

*Figure 12. Total resource choices for CME.*

**Effective Resources:**

The two most popular resources for this category were UpToDate and Medscape (see Figure 10). Because Medscape and links to Medscape’s CME platform own eMedicine, choosing either of these resources gives a combined total of 28% to Medscape’s interface. In total, MDConsult, from the numbers gathered in this research, is
not as popular a resource, but was selected correctly by three physicians (2%) as it does offer CME credits. The hand-held resource, ePocrates, also offers mobile CME credits.

Paper resources offer CME credits, which can be found in many professional journals such as the *Journal of the American Medical Association* or *The Medical Letter*. Paper CME products also accompany products like Audio-Digest, a recorded program of medical lectures that is issued monthly.

**Summary–Resource Selection: CME**

Effective resources were chosen by 77% of physicians, while 14 (23%) chose an ineffective resource (see Figure 13). CME is a straightforward subject that should be easy to locate. It is unlikely that physicians misinterpreted CME to mean personal educational efforts rather than courses that award CME credits. CME is the recognized term for courses that grant the minimum number of credits needed to meet state requirements for physician licensure.

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (7%)</td>
<td>None</td>
<td>UpToDate (28%)</td>
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<tr>
<td>Micromedex (10%)</td>
<td></td>
<td>eMedicine (4%)</td>
</tr>
<tr>
<td>Google (5%)</td>
<td></td>
<td>Medscape (24%)</td>
</tr>
<tr>
<td>Yahoo (1%)</td>
<td></td>
<td>MDConsult (2%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ePocrates (7%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>23%</td>
<td>0%</td>
</tr>
</tbody>
</table>

*Figure 13.* Efficacy of resources for CME.
Resource Choice Discussion: Drug or medication

Choosing an effective resource for drug information is very important since these resources should provide information on adverse reactions and drug recalls. Information should cover the main areas of concern for patients including possible side effects, drug interactions, and contraindications. Resource choices are seen in Figures 14 and 15.

Figure 14. Times each resource was selected first and second for drug or medication questions.
**Ineffective Resources:**

Google was selected by one physician as a first choice, the only choice that was ineffective. Web site search engines generate many hits for pharmaceutical companies, which are ordinarily at the top of the list. There are resources found in a Google search that are of value, but Google itself is the least effective way to find reliable drug or medication information.

![Pie chart showing resource choices for drug or medication questions.](image)

*Figure 15. Total resource choices for drug or medication questions.*

**Partially Effective Resources:**

Medscape offers an easy interface for drug information, complete with a drug interaction search tool. It is important to note, however, that Medscape accepts
advertisements from pharmaceutical companies and links to sites sponsored by these companies, which may influence physicians’ decisions. For this reason, it is considered partially effective, because it is important for medical resources to be impartial. In the terms of use found on the publisher’s Web site, Medscape informs its users that the drug interaction search tool only provides interactions for two drugs, a serious limitation as patients can be on more than two medications. The same company owns eMedicine, which connects to the same drug resources so there is no difference between these two resources for this subject.

MEDLINE allows a physician to locate accurate information, but it is not practical for clinical use. The information could be difficult to find unless the search was very specific. Paper resources can be reliable resources; unfortunately, even paper resources that send monthly updates would not disseminate alerts and approvals as quickly as online products.

Effective Resources

UpToDate offers a searchable drug resource produced by Lexi-Comp and provides reliable information. MDConsult was not selected but offers searchable drug information provided by Gold Standard, Inc. Because MDConsult is not a free service, like Medscape, it does not have advertising on its site. MDConsult also has a section on its home page dedicated to the latest drug notices including alerts for drug warnings and recalls; the site is updated daily and provides FDA approvals of new drugs.

Micromedex offers the most information, and is more in-depth than other resources. Physicians can enter lists of prescriptions and the database will identify any possible interactions. Only six (13%) selected Micromedex as first and second choice
(see Figure 10). Micromedex is considered the premier database, but it might not be available to all physicians because it is sold only to institutions. Its cost can make it unaffordable for hospitals. Since 38 physicians in this study had selected it as a first resource for other questions, it illustrates that at least 42% of the 90 physicians had access to Micromedex (see Figure 3). The resource for handheld devices, ePocrates, can be used in a physician’s office or at the bedside, and provides accurate information for immediate patient care needs.

Summary–Resource Selection: Drug or Medication

Physicians selected the correct resource 60% of the time as their first choice and 52% overall (see Figure 16). As UpToDate is perceived as the go-to resource for all questions, this would explain the higher selection accuracy for this area of interest.

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yahoo (0%)</td>
<td>eMedicine (3%)</td>
<td>MDConsult (0%)</td>
</tr>
<tr>
<td>Google (1%)</td>
<td>MEDLINE (8%)</td>
<td>UpToDate (37%)</td>
</tr>
<tr>
<td>Medscape (27%)</td>
<td>Micromedex (13%)</td>
<td></td>
</tr>
<tr>
<td>Paper (9%)</td>
<td></td>
<td>ePocrates (2%)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1%</td>
<td>47%</td>
</tr>
</tbody>
</table>

Figure 16. Efficacy of resources for drug or medication questions.

Resource Choice Discussion: Clinical questions

As the resource choice physicians made for this subject category were analyzed, a problem was identified with the subject, clinical questions. The complexity of the clinical
questions that physicians were trying to answer is unknown; therefore, there was no way to know if the answers they found were correct and adequately detailed. It would have been helpful to know if the answers simply “satisficed” the user (Bernard Schwartz Center for Economic Policy Analysis History of Economic Medicine, 2006), or if the desired level of detail was reached.

Resource choices are seen in Figures 17 and 18. Because the design of the questionnaire did not ask for the complexity of the clinical questions being answered, it is possible any of these resources might contain answers. In-depth probing of types of clinical questions would be necessary to further interpret effectiveness of resources used. For this reason, all resources were rated as effective as it is the question that dictates which resource would be able to produce a suitable answer.

*Ineffective Resources:*

None.

*Partially Effective Resources:*

None.
Figure 17. Times each resource was selected first and second for clinical questions.

**Effective Resources:**

Depending on the complexity of the question, MEDLINE and UpToDate could provide the correct answer. MEDLINE would involve a detailed search that would be more time intensive than is practical for most clinical questions. However, for challenging questions, MEDLINE is the only complete resource. Medscape, eMedicine, and MDConsult would be appropriate for clinical questions if the questions are straightforward. These resources would not be effective for concomitant conditions or complex disorders.
Like EMIPs, paper (11%) is an excellent resource for established treatments. There are thorough textbooks dedicated to a complete spectrum of medical conditions and treatments. However, they will not offer any new developments in treatment or discoveries in the causation of a disease. A good example is the discovery of helicobacter pylori, a bacterium that can cause stomach ulcers and stomach cancer. This finding rendered excellent gastroenterology textbooks obsolete on this subject until new editions could be released.
Eight physicians chose Micromedex, implying that some of the questions faced in clinical situations are related to medication. The other drug resource that would be appropriate is ePocrates.

A Google or Yahoo search could be used to find the established EBM treatment guidelines posted by government sites. Both search engines would also identify professional organizations that offer detailed information about conditions and treatments, but a physician would need the time and the ability to filter sites for the most reliable information. For this subject, physicians did not select search engines. It is possible that Google and other search engines are used, but physicians may not report their usage for clinical research because there might be some stigma attached to using a Web browser to find information for patient care.

**Resource Choice Discussion: Information to support your role as an instructor or medical school faculty**

This area of interest was selected by 20 physicians, and the selection of resources was different from other subject areas as this is the only area where UpToDate was not selected most often. As the number of physicians is small, numbers for resources one and two are combined (see Figure 19).
Figure 19. Times each resource was selected first and second to support the role of instructor or medical school faculty.

**Ineffective Resources:**

All the resources would provide information appropriate for teaching support.

**Partially Effective Resources:**

EMIPs would be secondary resources for instruction as they are summaries. As discussed earlier, these resources are authored, and some EMIPs are sponsored by pharmaceutical companies and other commercial supporters. With that caveat in mind, one can safely use these resources to find general diagnosis and well established treatment information.
Google and Yahoo could allow instructors to identify valuable sites for instruction. However, since there are already so many well-known, quality sites for science, biology, and medicine, Web search engines would appear to be a labor-intensive method of locating reliable information.

Effective Resources:

MEDLINE and paper, the two most common selections, are complementary for gathering information for instruction. MEDLINE would provide up-to-date journal references. The selection of paper (e.g., textbooks and journals), would provide the appropriate background needed to present complete information in a teaching scenario. It is not possible to identify whether this was the strategy of the resource users; however, the information gathered from both resources, if used together, would be effective.

Independently, paper can still be a good resource, depending on the text or journals used. Instruction does not always call for the most current information, and gold-standard texts that have been vetted by professionals through several editions can provide a thorough history and a present best-practice approach. Although an EMIP like UpToDate might be able to accomplish this, the subject coverage is not as in depth; rather, it is a good over-all text.

Micromedex and ePocrates are also valuable for instruction. Micromedex offers the most thorough information on drugs. The handheld product, ePocrates, is an easily portable resource that residents can be taught to use at the patient bedside for a quick drug consult.
Summary—Resource selection: Support the Role of Instructor of Medical School Faculty

Questions:

It is possible the resources listed as partially effective could supply information that would augment teaching, but these resources are not as focused as the resources indicated as effective (see Figure 20). Although ePocrates does not have the detail of Micromedex, it is an excellent teaching tool for using a handheld drug resource at the bedside, an important skill for busy clinicians.

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
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<tr>
<td>None</td>
<td>UpToDate (12%)</td>
<td>MEDLINE (32%)</td>
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<tr>
<td></td>
<td>eMedicine (3%)</td>
<td>Micromedex (10%)</td>
</tr>
<tr>
<td></td>
<td>Medscape (10%)</td>
<td>ePocrates (10%)</td>
</tr>
<tr>
<td></td>
<td>MDConsult (0%)</td>
<td>Paper (18%)</td>
</tr>
<tr>
<td></td>
<td>Google (5%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yahoo (0%)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>0%</strong></td>
<td><strong>30%</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>70%</strong></td>
</tr>
</tbody>
</table>

*Figure 20.* Efficacy of resource choices to support the role of instructor or medical school faculty.

**Resource Choice Discussion: Research (clinical trials, presentations, publications, etc.)**

Family physicians are usually not researchers as the specialty involves general care. For this reason, it is not surprising that only 12 physicians of 90 identified research as an area of interest (see Figure 21). Although this sample is too small for an accurate appraisal of the research practices of family practitioners, the poor choice of resources is
It is most important to note that no one resource is adequate, as research demands a thorough search of primary and historic resources. Although any of these resources could be used to find information that might be of value, the effective choices would be the fastest and most thorough. In addition, medical research demands a more rigorous adherence to exact research resources than other information needs might. Due to sample size, choices one and two have been combined for this discussion.

*Ineffective Resources:*

EMIPs, selected 10 of the 24 possible resource choices, are not an effective choice because the information is aggregated from other resources for the purpose of an overview. EMIPs are designed to be quick, easy-to-use tools for busy physicians and are not marketed as research resources. As mentioned previously in this paper, EMIPs can reflect the opinions of individual authors rather than an unbiased presentation of the information.

Google and Yahoo can be searched for information regarding a research topic, but they should not be among the first resources consulted. Physicians pursuing medical research should have baseline knowledge of the topic, and the possibility of negative consequences, particularly if human subjects are involved, makes the use of Web search engines an inappropriate choice. If a physician is preparing for a presentation or publication, the same standards apply, as the information being imparted has the potential to effect the practice of medicine. The handheld resource, ePocrates, is designed to be a quick bedside resource for PDAs and handheld devices and would not be appropriate for detailed research.
Figure 21. Times each resource was selected first and second to find information for research.

**Partially Effective Resources:**

Paper can be useful, as in searching textbooks for background information, such as an historical overview. Some textbooks have been reviewed by editors and physicians through several editions and in some cases have been acknowledged as a core resource in a specialty. Texts would need to be augmented with a MEDLINE search for deeper historical research and the most current information.
**Effective Resources:**

For research, the most appropriate resource is MEDLINE. With OLDMEDLINE’s ability to find historical publications and PreMEDLINE’s presentation of the newest research, MEDLINE is the most complete resource for research. Micromedex is the ideal complement for drug research because of its accuracy and thoroughness.

*Summary–Resource selection: Support Research (clinical trials, presentations, publications, etc.):*

The most important feature for resources used for research is their reliability. Although all resources in this group have information to offer, the most rigorous resources should be consulted first (see Figure 22).

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>UpToDate (17%)</td>
<td>Paper (12%)</td>
<td>MEDLINE (8%)</td>
</tr>
<tr>
<td>eMedicine (0%)</td>
<td></td>
<td>Micromedex (21%)</td>
</tr>
<tr>
<td>Medscape (17%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDConsult (8%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ePocrates (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Google (17%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yahoo (0%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>59%</strong></td>
<td><strong>29%</strong></td>
</tr>
</tbody>
</table>

*Figure 22. Efficacy of resource choices for research.*
**Resource Choice Discussion: EBM**

EBM was the area of least interest. The number of physicians interested in EBM is small but does reveal some large information literacy gaps. According to professional organizations and government resources, physicians should be providing consistent treatment of patients using the latest information (U.S. National Academy of Sciences, Institute of Medicine, and Committee on Quality of Health Care in America, 1999). If they do not, this may be due, in part, to confusion over what EBM is and where to find the information. Family practice involves serving patients of all ages, diagnosing and treating a broad spectrum of medical problems, and physicians in practice would be in a position to benefit from the established treatment protocols that EBM offers. Because the sample group was small, resource choices are discussed with choices one and two combined (see Figure 23).

*Ineffective Resources:*

UpToDate was chosen, perhaps because many physicians believe it is evidence-based. As discussed earlier in this report, it is not. EMIPs, despite their claims, do not follow the rigorous methods required to qualify as EBM research.

*Partially Effective Resources:*

Google and Yahoo were not selected and could be good choices because they would lead physicians to professional organizations and government sites that host EBM materials. “Evidence based medicine” or “EBM” would have to be one of the subject terms used. EBM guidelines are also available in paper formats, but paper was not selected. It is important, however, to ensure that the latest version is being used so paper resources would only be partially effective. If the goal were to establish the efficacy of a
drug and the conditions that the FDA has approved this drug to treat, Micromedex and ePocrates would be effective resources. EMIPs also have drug and pharmaceutical sections that offer this information.

*Figure 23.* Times each resource was selected first and second for EBM questions.

**Effective Resources:**

Four physicians consulted MEDLINE first. MEDLINE has an application to enable a quick search for EBM and meta-analysis articles.

**Summary—Resource selection: EBM:**

EBM resources are the integration of the current best evidence available from systematic research. A physician can use one of the excellent EBM sites, such as the
National Guideline Clearinghouse\textsuperscript{6}, but for the resources listed here, the most reliable and complete is MEDLINE (see Figure 24).

<table>
<thead>
<tr>
<th>Ineffective</th>
<th>Partially effective</th>
<th>Effective</th>
</tr>
</thead>
<tbody>
<tr>
<td>UpToDate (45%)</td>
<td>Micromedex (5%)</td>
<td>MEDLINE (35%)</td>
</tr>
<tr>
<td>eMedicine (10%)</td>
<td>ePocrates (0%)</td>
<td></td>
</tr>
<tr>
<td>Medscape (5%)</td>
<td>Paper (0%)</td>
<td></td>
</tr>
<tr>
<td>MDConsult (0%)</td>
<td>Google (0%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yahoo (0%)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>60%</td>
<td>5%</td>
</tr>
</tbody>
</table>

\textit{Figure 24.} Efficacy of resource choices for EBM.

**Resource Choice Selection: Conclusion**

Resource selection for each subject area was analyzed. Physicians had the most difficulty selecting effective resources for staying current—the topic selected by the most physicians. Inversely, over two thirds of physicians selected the correct resources for CME. In both cases, however, physician perceived success of 76-100% was approximately 50%. Eliminating research and EBM as outliers, the average perceived success of 76-100% was 47%. Only resources for drug or medication questions appeared to correlate with the high perceived success rate.

Table 7 contains an overview of the efficacy of resources selected that are compared to the desirable outcome of 76-100% perceived success with search results. The perception of success did not coincide with the effectiveness of the resources used.

\textsuperscript{6} http://www.guideline.gov
Table 7

**Total Scores of Efficacy of Resource Selection Compared with 76-100% Perception of Success by Physicians**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Not effective</th>
<th>Partially Effective</th>
<th>Effective</th>
<th>76-100% Perceived Success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay Current</td>
<td>60%</td>
<td>26%</td>
<td>14%</td>
<td>54%</td>
</tr>
<tr>
<td>CME</td>
<td>23%</td>
<td>0%</td>
<td>77%</td>
<td>50%</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>1%</td>
<td>47%</td>
<td>52%</td>
<td>47%</td>
</tr>
<tr>
<td>Clinical</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>40%</td>
</tr>
<tr>
<td>Support Role</td>
<td>0%</td>
<td>30%</td>
<td>70%</td>
<td>45%</td>
</tr>
<tr>
<td>Research</td>
<td>59%</td>
<td>12%</td>
<td>29%</td>
<td>75%</td>
</tr>
<tr>
<td>EBM</td>
<td>60%</td>
<td>5%</td>
<td>35%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Users’ perception of success when looking for information for the top five subject areas was moderate, even when correct resources were used. Physicians consistently used the same resources in the same sequence, regardless of the difference in the information sought. These results coincide with the information found in Table 3, where only 39 (43%) of physicians rated themselves as very satisfied overall with their search results. These results reject the hypothesis that physicians are satisfied with the results of their research, whether or not they have used the most effective resource. When the subject areas, research, and EBM were dropped as outliers because of the small subject response, 47% rated their searches as successful 76-100% of the time. This suggests that
physicians’ lack of understanding of what the resources are designed to do could be negatively affecting their level of satisfaction.

**Perceived Success**

Physician perceptions of success when not associated with a specific subject (see Table 3), and perceptions gauging their success when it related to a specific subject were compared. Table 3 shows the results of a three-point scale for satisfaction and Tables 8 and 9, a four-point scale for success.

**Table 8**

*Perceived Success of Information Searches in Subject Areas*

<table>
<thead>
<tr>
<th>Subject</th>
<th>Perceived success 0-25%</th>
<th>Perceived success 26-50%</th>
<th>Perceived Success 51-75%</th>
<th>Perceived Success 76-100%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay current</td>
<td>4</td>
<td>20</td>
<td>48</td>
<td>84</td>
<td>156</td>
</tr>
<tr>
<td>CME</td>
<td>0</td>
<td>13</td>
<td>47</td>
<td>60</td>
<td>120</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>2</td>
<td>12</td>
<td>37</td>
<td>45</td>
<td>96</td>
</tr>
<tr>
<td>Clinical</td>
<td>1</td>
<td>14</td>
<td>35</td>
<td>34</td>
<td>84</td>
</tr>
<tr>
<td>Support role</td>
<td>2</td>
<td>6</td>
<td>14</td>
<td>18</td>
<td>40</td>
</tr>
<tr>
<td>Research</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>EBM</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>14</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
<td><strong>66</strong></td>
<td><strong>192</strong></td>
<td><strong>273</strong></td>
<td><strong>540</strong></td>
</tr>
</tbody>
</table>
Table 9

*Percentage of Perceived Success of Information Searches in Subject Area*

<table>
<thead>
<tr>
<th>Subject</th>
<th>% Perceived success 0-25%</th>
<th>% Perceived success 26-50%</th>
<th>% Perceived Success 51-75%</th>
<th>% Perceived Success 76-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay current</td>
<td>2%</td>
<td>13%</td>
<td>31%</td>
<td>54%</td>
</tr>
<tr>
<td>CME</td>
<td>0%</td>
<td>11%</td>
<td>39%</td>
<td>50%</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>2%</td>
<td>12%</td>
<td>39%</td>
<td>47%</td>
</tr>
<tr>
<td>Clinical</td>
<td>1%</td>
<td>17%</td>
<td>42%</td>
<td>40%</td>
</tr>
<tr>
<td>Support role</td>
<td>5%</td>
<td>15%</td>
<td>35%</td>
<td>45%</td>
</tr>
<tr>
<td>Research</td>
<td>0%</td>
<td>0%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>EBM</td>
<td>0%</td>
<td>5%</td>
<td>25%</td>
<td>70%</td>
</tr>
<tr>
<td>Average</td>
<td>2%</td>
<td>12%</td>
<td>36%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Tables 8 and 9 show that half of physicians rated their success in the 76-100% range but the percentage was inflated by two subject areas with low numbers of physicians. Removing these two outliers narrows the average perceived success rate of 76-100% success to 47%. With the outliers eliminated, those who rated their success with their search results 51-75% of the time comprised another 37%.

For the purposes of comparison, the rating of “not at all satisfied” in Table 3 was considered equal to 0-25% perceived success in Tables 12 and 13; the rating of “somewhat satisfied” to the range of 26-75%, and the rating of “very satisfied” to 76-
100%. Results regarding overall perception of success were compared to Question 3 (see Table 3), which showed that 43% of physicians were very satisfied with their search results. The self-rated satisfaction and self-rated success when based on searching for information for specific subjects did not agree with physicians’ overall satisfaction with their searching abilities reported in the literature (Haynes, Johnston, et al., 1993; McGowan & Berner, 2004; Scott, Schaad, Mandel, Brock, & Kim, 2000). These studies claimed that physicians were satisfied with their results regardless of the accuracy of the information they retrieved. This discrepancy might be due, in part, to this study’s question design that allowed physicians to indicate if they perceived their search as “somewhat” successful. Other studies did not ask physicians to weight their level of satisfaction. As shown earlier in Table 7, using the correct resources did not correlate with physicians’ perceptions of success which disproves the hypothesis that physicians are satisfied with the results of their research whether or not they have used the most effective resource.

When examining perceptions of success in the 76-100% range when using the five most heavily used resources, (UpToDate, Medscape, MEDLINE, Micromedex, and paper), users of UpToDate, Medscape, and Micromedex were first, second, and third; MEDLINE was fourth (see Tables 10 and 11). It is to be expected that, based on information trends for easier interfaces, two EMIPs and Micromedex would rate higher than MEDLINE. The complexity of MEDLINE could most certainly affect the perceived success of a search for information.
Table 10

*Perceived Success of Information Searches by Resource*

<table>
<thead>
<tr>
<th>Resource</th>
<th>Perceived success 0-25%</th>
<th>Perceived success 26-50%</th>
<th>Perceived success 51-75%</th>
<th>Perceived success 76-100%</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>1</td>
<td>12</td>
<td>29</td>
<td>37</td>
<td>79</td>
</tr>
<tr>
<td>UpToDate</td>
<td>2</td>
<td>19</td>
<td>54</td>
<td>90</td>
<td>165</td>
</tr>
<tr>
<td>eMedicine</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>11</td>
<td>23</td>
</tr>
<tr>
<td>Medscape</td>
<td>3</td>
<td>6</td>
<td>35</td>
<td>47</td>
<td>91</td>
</tr>
<tr>
<td>MDConsult</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Micromedex</td>
<td>3</td>
<td>9</td>
<td>22</td>
<td>39</td>
<td>73</td>
</tr>
<tr>
<td>ePocrates</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>12</td>
<td>21</td>
</tr>
<tr>
<td>Paper</td>
<td>0</td>
<td>11</td>
<td>24</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>Google</td>
<td>0</td>
<td>4</td>
<td>3</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>66</td>
<td>192</td>
<td>273</td>
<td>540</td>
</tr>
</tbody>
</table>

In Figure 25, the top five resources were compared to their rating for 76-100% perceived success. The perceived-success rating for each resource varied by, at most, an average of 5% from the mean of 50%. Even with perceived similarities in success, the ranking of resources did not fluctuate as dramatically, with UptoDate being selected almost twice as often as the other resources. Looking at Table 7, an average of 47% of
physicians rated their success as 76-100% when searching in the top four subject areas yet continued to use the same five resources. UpToDate was chosen first consistently.

Table 11

*Percentage of Perceived Success of Information Searches by Resource*

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Perceived success 0-25%</th>
<th>% Perceived success 26-50%</th>
<th>% Perceived success 51-75%</th>
<th>% Perceived success 76-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>1%</td>
<td>15%</td>
<td>37%</td>
<td>47%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1%</td>
<td>11%</td>
<td>33%</td>
<td>55%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>0%</td>
<td>9%</td>
<td>43%</td>
<td>48%</td>
</tr>
<tr>
<td>Medscape</td>
<td>3%</td>
<td>7%</td>
<td>38%</td>
<td>52%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>0%</td>
<td>30%</td>
<td>50%</td>
<td>20%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>4%</td>
<td>12%</td>
<td>30%</td>
<td>54%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>0%</td>
<td>0%</td>
<td>43%</td>
<td>57%</td>
</tr>
<tr>
<td>Paper</td>
<td>0%</td>
<td>18%</td>
<td>40%</td>
<td>42%</td>
</tr>
<tr>
<td>Google</td>
<td>0%</td>
<td>23%</td>
<td>18%</td>
<td>59%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>2%</strong></td>
<td><strong>12%</strong></td>
<td><strong>36%</strong></td>
<td><strong>50%</strong></td>
</tr>
</tbody>
</table>

If these resources appear to satisfy the need for an answer only 50% of the time, it is remarkable that physicians continue to use the same five resources in the same order. It may be that the physicians continue to go to the resources with which they are familiar. A
resource can be chosen because it is convenient (Koonce, Giuse, & Todd, 2004). It is unlikely that physicians would repeatedly use the same resources if they perceived them as inferior or incapable of answering the question, but would go to another resource for particular questions. Convenience might dictate one resource being selected first, but as the use is so consistent for the same resources, this supports the hypothesis, that physicians perceive all resources as having the same level of functionality.

**Figure 25.** Top five resources and perceived success of finding information 76-100% of the time.
Comparison of Time Spent in a Resource and Perception of Success

Data in this section was collected to identify attributes that might affect a physician’s perception of the capabilities of a resource. The amount of time spent in a resource is relevant because the perceived ease and speed with which an answer was found might be one of the variables that could influence physicians’ satisfaction with search results.

Perceived Time Spent by Area of Interest

Physicians were asked to rank the amount of time they spent in a resource once they located the data they were seeking (see Tables 12 and 13). Asking physicians to report the time spent after they found the data eliminated the time spent searching through resources until they found their answer and focused on the resource they identified as effective.

Table 12

*Number of Physicians by Minutes Spent in Each Resource by Subject Area*

<table>
<thead>
<tr>
<th>Subject</th>
<th>1-5 min.</th>
<th>6-15 min.</th>
<th>16-30 min.</th>
<th>&gt;30 min.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay current</td>
<td>29</td>
<td>74</td>
<td>41</td>
<td>12</td>
<td>156</td>
</tr>
<tr>
<td>CME</td>
<td>24</td>
<td>50</td>
<td>30</td>
<td>16</td>
<td>120</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>17</td>
<td>42</td>
<td>25</td>
<td>12</td>
<td>96</td>
</tr>
<tr>
<td>Clinical</td>
<td>17</td>
<td>49</td>
<td>13</td>
<td>5</td>
<td>84</td>
</tr>
<tr>
<td>Support role</td>
<td>6</td>
<td>11</td>
<td>13</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>
Table 13

*Percentage of Physicians by Minutes Spent in Each Resource by Subject Area*

<table>
<thead>
<tr>
<th>Subject</th>
<th>1-5 min.</th>
<th>6-15 min.</th>
<th>16-30 min.</th>
<th>&gt;30 min.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research</td>
<td>4</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>EBM</td>
<td>2</td>
<td>8</td>
<td>6</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>99</td>
<td>249</td>
<td>133</td>
<td>59</td>
<td>540</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject</th>
<th>% 1-5 min.</th>
<th>% 6-15 min.</th>
<th>% 16-30 min.</th>
<th>% &gt;30 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stay current</td>
<td>19%</td>
<td>47%</td>
<td>26%</td>
<td>8%</td>
</tr>
<tr>
<td>CME</td>
<td>20%</td>
<td>42%</td>
<td>25%</td>
<td>13%</td>
</tr>
<tr>
<td>Drug or Med</td>
<td>18%</td>
<td>44%</td>
<td>26%</td>
<td>12%</td>
</tr>
<tr>
<td>Clinical</td>
<td>20%</td>
<td>58%</td>
<td>16%</td>
<td>6%</td>
</tr>
<tr>
<td>Support role</td>
<td>15%</td>
<td>27%</td>
<td>33%</td>
<td>25%</td>
</tr>
<tr>
<td>Research</td>
<td>17%</td>
<td>62%</td>
<td>21%</td>
<td>0%</td>
</tr>
<tr>
<td>EBM</td>
<td>10%</td>
<td>40%</td>
<td>30%</td>
<td>20%</td>
</tr>
<tr>
<td>Average</td>
<td>18%</td>
<td>46%</td>
<td>25%</td>
<td>11%</td>
</tr>
</tbody>
</table>
Perceived Time Spent by Resource

As indicated in Tables 14 and 15, approximately 50% of physicians who used the top four resources, MEDLINE, UpToDate, Medscape, and paper, used them for 6-15 minutes. MEDLINE is used by the fewest physicians in the 1-5 minute range, and the most physicians in the >30 range.

Table 14

*Number of Physicians by Minutes Spent in Each Resource*

<table>
<thead>
<tr>
<th>Resource</th>
<th>1-5 min.</th>
<th>6-15 min.</th>
<th>16-30 min.</th>
<th>&gt;30 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>4</td>
<td>37</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>UpToDate</td>
<td>30</td>
<td>74</td>
<td>50</td>
<td>11</td>
</tr>
<tr>
<td>eMedicine</td>
<td>2</td>
<td>14</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Medscape</td>
<td>10</td>
<td>50</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>MDConsult</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Micromedex</td>
<td>29</td>
<td>27</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td>ePocrates</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Paper</td>
<td>14</td>
<td>33</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>Google</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Yahoo</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99</strong></td>
<td><strong>249</strong></td>
<td><strong>133</strong></td>
<td><strong>59</strong></td>
</tr>
</tbody>
</table>
Table 15

*Percentage of Physicians by Minutes Spent in Each Resource*

<table>
<thead>
<tr>
<th>Resource</th>
<th>% 1-5 min.</th>
<th>% 6-15 min.</th>
<th>% 16-30 min.</th>
<th>% &gt;30 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>5%</td>
<td>47%</td>
<td>30%</td>
<td>18%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>18%</td>
<td>45%</td>
<td>30%</td>
<td>7%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>9%</td>
<td>61%</td>
<td>17%</td>
<td>13%</td>
</tr>
<tr>
<td>Medscape</td>
<td>11%</td>
<td>55%</td>
<td>20%</td>
<td>14%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
<td>0%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>40%</td>
<td>37%</td>
<td>16%</td>
<td>7%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>10%</td>
<td>19%</td>
<td>38%</td>
<td>33%</td>
</tr>
<tr>
<td>Paper</td>
<td>23%</td>
<td>55%</td>
<td>14%</td>
<td>8%</td>
</tr>
<tr>
<td>Google</td>
<td>18%</td>
<td>35%</td>
<td>41%</td>
<td>6%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>18%</strong></td>
<td><strong>46%</strong></td>
<td><strong>25%</strong></td>
<td><strong>11%</strong></td>
</tr>
</tbody>
</table>

Micromedex, the other resource in the top five, was used most in the 1-5 minute span, probably due to the straightforward nature of most medication questions and the simplified site layout. Paper also had a higher number of users in the 1-5-minute span, another resource that lends itself to quick consultation. Both of these resources averaged approximately 78% of their users from one to fifteen minutes.
There did not appear to be a strong relationship between the shortest amount of time used and resource rank (see Figure 26). Rather, the 1-5 minute usage would seem to reflect the capabilities of the resources, in other words, their ease of use. Except for Micromedex, the percentage of physicians using resources for 1-5 minutes did not indicate that the shortest time indicated the most used resources. Time preference is not simply the shortest amount of time one can spend, but the shortest amount of time to achieve finding the information sought. Apparently, 1-5 minutes is not enough time to find a satisfactory answer.

*Figure 26. Number of physicians who spent 1-5 minutes in the top five resources.*
Time Spent with a Resource and Perceived Success

Looking again at the percentage of physicians in each span of time for the resources they used, the top five most selected resources were compared with the amount of time spent using the resource. Overall, the most common amount of time spent with the five most used resources was 6-15 minutes by 40 to 55% of physicians (see Figure 27). Only Micromedex use was reported in the 1-5 minute range by 40% of its users, probably due to the straightforward interface, which allows a physician to enter the name of a drug with no search terms or other limiters.

Figure 27. Time spent in the top five resources.
The five resources in the 6-15 minute time range did not align precisely with the rankings of the same resources for usage. The order for the five most used resources was UpToDate (31%), Medscape (17%), MEDLINE (15%), Micromedex (13%), and paper (11%) (see Figure 27). The order for the 6-15 minutes time range was Medscape, paper, MEDLINE, UpToDate, and Micromedex (see Figure 27). The order for the for the 6-15 minutes time range was Medscape, paper, MEDLINE, UpToDate, and Micromedex (see Figure 27). However, four of the most used resources were used most in 6-15 minutes and Micromedex, used most in the 1-5 minute range. The 6-15 minute range may define the optimum amount of time a physician can devote to information seeking for one question in these resources with Micromedex being optimal at 1-5 minutes.

The most often selected time range for subjects (Tables 8 and 9) and resources (Tables 10 and 11) was 6-15 minutes. It is significant that these time spans are self-reported. Since the 6-15 minute time span is consistent across subjects and resources, it implies the physicians believe that resources and subject areas should require the same amount of time. This, combined with consistently choosing the same resources despite differences in the information needed, supports the hypotheses that physicians perceive all electronic resources as being equally current and thorough and with the same level of functionality. The persistent use of these resources for the same time span implies that each resource is similar enough to be used effectively in that time frame.

Summary of Resource Selection, Perception of Success, and Time Spent by Subject

Stay Current in Medicine

Most physicians (66%) spent no more than 15 minutes reviewing information to stay current (See Tables 8). As shown in Table 2, 28% reported using the computer more
than 40 times in one month. This time would have been allocated across all the subject areas reported by physicians, not just to stay current. As reported earlier in this study, Alper, Hand, Elliott, Kinkade, Hauan, Onion, et al. (2004) reported that a primary care physician would have to spend 627.5 hours per month to stay current. If only 28% of physicians are accessing the computers more than 40 times in one month for all of their questions, usually for no more than 15 minutes, the goal of staying current is unlikely to be met.

It is important to note that in Figure 9, the resource selected most often for staying current overall was UpToDate (35%), a resource, which is not appropriate for finding current information. Its popularity may be driven, in part, by the ease of access and the minimal investment of time in finding a subject (63% spent 15 minutes or less). Only 14% chose MEDLINE as the most effective resource although it will e-mail updated search results to physicians. RSS feeds to tables of contents would be an effective way for physicians to stay current, although subjects did not suggest this information technology as an alternate selection. EMIPs provide headline information and tables of contents that help with currency, but these resources would not be able to provide the specifics that a specialist needs to stay current. Even so, although 47% of physicians used UpToDate or Medscape, 54% rated their perceived success between 76-100% (see Table 7).

**Continuing Medical Information (CME)**

In total, 77% of physicians chose resources that offer CME for either their first or second choice (see Figure 12), but only 50% of physicians perceived their results as successful 76-100% (see Table 7). CME is straightforward and ordinarily requires a
physician to read a case study or article and then complete a questionnaire. Physicians may be judging their successful CME completion as their perceived success rather than successfully finding a resource that offers CME. As physicians only receive credits when the questionnaire is correct, the 6-15 minute time span, chosen by 42% of physicians, might not be adequate.

**Drug and Medication Questions**

Drug and medication questions appeared to be challenging for physicians as only 47% reported perceived success of 76-100% (see Table 7) with 52% consulting effective resources (see Figure 16). Since 44% of physicians spent 6-15 minutes searching for information in this subject area, and 32% searched MEDLINE, the time allotted for MEDLINE may be part of the difficulty. This resource is complex and drug searches can be multifaceted. Since drug errors are one of the medical errors identified as a serious problem in health care, perhaps the anxiety of finding the right answer might leave a physician unsure about their search results.

**Clinical Questions**

As with other subject areas, 49 (58%) of physicians reported using resources for clinical information for 6-15 minutes (see Table 9). Resource selection for clinical questions was appropriate, as any of the resources could have been effective depending on the nature of the question. This should have resulted in a high perception of success. Instead, only 40% of physicians perceived their success at 76-100% by (see Table 7). It is noteworthy that 20% of physicians only spent 1-5 minutes with a resource, which might have affected their ability to find a satisfying answer.
Dissatisfaction with results may also be due, in part, to the complexity of some of the clinical questions. If a question is involved enough to investigate, it may be difficult to find a satisfying, complete answer. EMIPs are popular in a clinical setting because of their ease of use, but the simplicity of the interface may make it more challenging to do a detailed search that will pinpoint the information needed. If the physician is looking for drug information, this could compound the difficulty.

Support the Role of Instructors or Medical School Faculty

Although the sample was small (n=20), some observations can be made. In total, 58% of physicians spent 16 > 30 minutes, longer than physicians spent in these two time spans searching for any other subject (see Table 9). Perception of success was rated between 76-100% by only 45%, although 70% had selected resources that were effective (see Table 7). Preparation for instructing students is time-intensive, and 32% used MEDLINE, which requires more time intensive searching. Finding materials for teaching would also involve the inclusion of clinical cases and professional knowledge. Taking this into account, it is unreasonable to expect all the information to be met by electronic resources. As these physicians are rating their perceived success with these resources, however, the lack of satisfaction could mean they expected to find more information in these resources.

Research (clinical trials, presentations, publications, etc.)

This question included definitions of research activities (clinical trials, presentations, publications, etc.) to help physicians understand the level of research described by this category. It was surprising that, even in this small sample (n=6 or 12 responses based on first and second resource choices) (see Figure 21), 62% of physicians
spent only 6-15 minutes in these resources, and no physician searched for 30 or more minutes (see Tables 8 and 9). More time should be allocated for research. Satisfaction, however, for 75% participants was between 76-100% (see Table 7). While 70% had selected an effective resource, it is alarming that the perception of success was unexpectedly high after so little time spent with the resources. Even with the definition of research included in the question, physicians must have included researching for their own edification.

Evidence Based Medicine (EBM) Reviews

There were fewer physicians interested in EBM than expected (n=10 or 20 responses based on first and second resource choices). This specialty provides direct care, and may already have some established evidence-based guidelines that they follow. The choice of UpToDate, eMedicine, and Medscape suggest that these 10 physicians did not grasp the concept of EBM resources.

Summary of Resource Selection, Time Spent by Subject, and Perceived Success

It is impossible to render absolute judgments on the resources selected by physicians for particular subject areas. There may be gray areas based on the complexity of the question. The perceived gradations of success, such as 76-100%, can also be difficult to interpret as it compels someone who does not feel completely successful to make a judgment of being more than 75% satisfied with search results.

The discrepancies of the efficacy of resources selected with the perception of success illustrate the confusion surrounding resource choices and satisfaction with results. The numbers imply in some cases, such as CME, that physicians were not
confident, even when they were using the correct resource. These findings reject the hypothesis that physicians are satisfied with the results of their search whether or not they have used the most effective resource. As demonstrated here, physicians are unsure of their results even when the effective resource is used.

The largest percentage of physicians (45%) indicated they spent 6-15 minutes with a resource, and 18% spent 1-5 minutes. Physicians have limited time to search for information, and this could have a negative impact on their use of information resources. Some resource choices indicated a lack of understanding of the capabilities of a resource. Although physicians may have spent less time in some resources, UpToDate was still the most used. Time limitations would certainly make the choice of a simple interface, such as UpToDate, an appealing resource, even if it is not the best choice.

It is apparent that physicians did not understand the functionality of these resources, supporting hypotheses one and two. Repeated errors in resource selection demonstrated the physicians’ inability to choose a resource based on information need rather than preference.

**Rating of Resources Independent of Specific Subject areas**

Physicians were asked to rate the resources assessed throughout this study, independent of using the resource to find information. This exercise was to establish if their use of resources agreed with the rating given each resource’s attributes. How physicians use resources and their perceptions of success with their search results by subject have already been examined here; what follows is a discussion of how each resource was rated for usefulness, currency, thoroughness, and speed. These results then
were compared to the frequency with which each resource was used. This further investigated the hypotheses that physicians perceive all resources to be equally current and thorough, and think that all resources have the same level of functionality.

**Usefulness**

Physicians were asked to rate overall usefulness of a list of resources (see Figure 28 and Table 16). UpToDate received the highest ratings in the category “very useful.” This perception of usefulness by a high number of physicians could explain the selection of UpToDate received the highest rating for every attribute. When comparing these ratings with the top five resources, (UpToDate, Medscape, MEDLINE, Micromedex, and Paper (see Figure 6), the resources rated most useful are also the top five resources, with MEDLINE as last on the list.

Usefulness was the category that had the highest percentage of physicians who rated a resource in the “not at all” category and the lowest percentage resource rating for “very” compared to the other attribute ratings. Physicians may have judged the concept of usefulness more stringently. If a resource is not perceived as useful, the other traits are not important. This resulted in more noticeable variations in the scores than in other attributes.

Resources that were chosen by 4% of physicians or less when selecting resources to search for information (see Figure 6) were all rated as somewhat useful by more than 50% of physicians. However, Yahoo and MDConsult received the highest percentage of physicians rating them as not at all useful, corroborating their low ranking. Removing UpToDate’s rating of 25% in the “somewhat” category as an outlier meant that 52% of
physicians gave resources a rating of “somewhat useful.” Even with the fluctuation in scores (see Figure 28), physicians’ perceptions of similar functionality can be seen in the fairly consistent “somewhat” category.

Figure 28. Physician ranking of perceived usefulness of resources.
Table 16

Percentage of Perceived Usefulness of Information Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Not at all</th>
<th>% Somewhat</th>
<th>% Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>11%</td>
<td>48%</td>
<td>41%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>7%</td>
<td>25%</td>
<td>68%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>18%</td>
<td>59%</td>
<td>23%</td>
</tr>
<tr>
<td>Medscape</td>
<td>4%</td>
<td>49%</td>
<td>47%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>33%</td>
<td>55%</td>
<td>12%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>12%</td>
<td>41%</td>
<td>47%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>3%</td>
<td>56%</td>
<td>41%</td>
</tr>
<tr>
<td>Paper</td>
<td>5%</td>
<td>54%</td>
<td>41%</td>
</tr>
<tr>
<td>Google</td>
<td>8%</td>
<td>52%</td>
<td>40%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>28%</td>
<td>54%</td>
<td>18%</td>
</tr>
<tr>
<td>Average</td>
<td>13%</td>
<td>49%</td>
<td>38%</td>
</tr>
</tbody>
</table>

Currency

As seen in Figure 29 and Tables 17, MEDLINE and UpToDate were both rated as very current with 77% of physicians demonstrating that they do not understand
UpToDate’s limitations or MEDLINE’s capabilities. The top five resources (see Figure 6) were rated the top five in currency.

Resources that were not selected to search subject areas were given higher scores than expected. MDConsult, selected by only 2% of the physician when indicating resources they use, was rated somewhat current by 60%. Resources that were selected for use by between 1% and 4% of physicians garnered ratings of “somewhat current” by 48% to 61% of physicians.

Figure 29. Physician ranking of perceived currency of resources.
Table 17

*Percentage of Perceived Currency of Information Resources*

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Not at all</th>
<th>% Somewhat</th>
<th>% Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>1%</td>
<td>22%</td>
<td>77%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>3%</td>
<td>22%</td>
<td>77%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>3%</td>
<td>49%</td>
<td>48%</td>
</tr>
<tr>
<td>Medscape</td>
<td>1%</td>
<td>39%</td>
<td>60%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>9%</td>
<td>61%</td>
<td>30%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>5%</td>
<td>41%</td>
<td>54%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>9%</td>
<td>48%</td>
<td>43%</td>
</tr>
<tr>
<td>Paper</td>
<td>3%</td>
<td>57%</td>
<td>40%</td>
</tr>
<tr>
<td>Google</td>
<td>7%</td>
<td>54%</td>
<td>39%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>18%</td>
<td>60%</td>
<td>22%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>6%</strong></td>
<td><strong>45%</strong></td>
<td><strong>49%</strong></td>
</tr>
</tbody>
</table>

**Thoroughness**

The scores for “very thorough” were, for the most part, lower than the scores for “very” in usefulness and currency. Paper and Micromedex received lower ratings in “very thorough” than for usefulness and currency. These resources do focus on specific
areas of information and would not be as all-encompassing as some of the other resources (see Figure 30 and Table 18.)

Figure 30. Physician ranking of perceived thoroughness of resources.

UpToDate was perceived to be as thorough as MEDLINE by the majority of physicians. Thoroughness may be defined by physicians as not necessarily all of the information that is available, but all of the information that meets their needs. Figure 30 illustrates the high perception of thoroughness of some resources. Resources such as Micromedex are rated “very through” by 37% but is the most complete compendium of the drug resources on the list and certainly more complete than ePocrates, rated “very” by 58%.
Table 18

*Percentage of Perceived Thoroughness of Information Resources*

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Not at all</th>
<th>% Somewhat</th>
<th>% Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>1%</td>
<td>32%</td>
<td>67%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>3%</td>
<td>25%</td>
<td>72%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>7%</td>
<td>54%</td>
<td>39%</td>
</tr>
<tr>
<td>Medscape</td>
<td>3%</td>
<td>44%</td>
<td>53%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>7%</td>
<td>59%</td>
<td>34%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>7%</td>
<td>56%</td>
<td>37%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1%</td>
<td>41%</td>
<td>58%</td>
</tr>
<tr>
<td>Paper</td>
<td>6%</td>
<td>60%</td>
<td>34%</td>
</tr>
<tr>
<td>Google</td>
<td>13%</td>
<td>59%</td>
<td>28%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>29%</td>
<td>57%</td>
<td>14%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>8%</strong></td>
<td><strong>49%</strong></td>
<td><strong>43%</strong></td>
</tr>
</tbody>
</table>

**Speed**

UpToDate again received the highest rating. The speed of MEDLINE was rated only “very” fast by 36 (40%) most likely due to its complexity—a problem when a physician needs a quick answer (see Figure 31 and Table 19).
Figure 31. Physician ranking of perceived speed of resources.

EPocrates was rated high as it was in the top five categories for usefulness, currency, and thoroughness. Speed was the only area in which it received a low percentage for “very.” EPocrates is designed to be used quickly on a handheld device. The perception may be influenced by the proficiency needed to use a handheld device. If physicians primarily search databases, it is possible that they are simply not as familiar with the handheld interface. MEDLINE’s low rating for speed does identify its limitation as a complex resource, and physicians rated paper as faster. Micromedex has a search box that allows a physician simply to enter a drug name to find information. It is not surprising it was rated “very” fast by 60% of physicians.
Table 19

**Percentage of Perceived Speed of Information Resources**

<table>
<thead>
<tr>
<th>Resource</th>
<th>% Not at all</th>
<th>% Somewhat</th>
<th>% Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE</td>
<td>6%</td>
<td>54%</td>
<td>40%</td>
</tr>
<tr>
<td>UpToDate</td>
<td>2%</td>
<td>30%</td>
<td>68%</td>
</tr>
<tr>
<td>eMedicine</td>
<td>2%</td>
<td>61%</td>
<td>37%</td>
</tr>
<tr>
<td>Medscape</td>
<td>3%</td>
<td>45%</td>
<td>52%</td>
</tr>
<tr>
<td>MDConsult</td>
<td>4%</td>
<td>70%</td>
<td>26%</td>
</tr>
<tr>
<td>Micromedex</td>
<td>2%</td>
<td>38%</td>
<td>60%</td>
</tr>
<tr>
<td>ePocrates</td>
<td>19%</td>
<td>64%</td>
<td>17%</td>
</tr>
<tr>
<td>Paper</td>
<td>3%</td>
<td>49%</td>
<td>48%</td>
</tr>
<tr>
<td>Google</td>
<td>9%</td>
<td>44%</td>
<td>47%</td>
</tr>
<tr>
<td>Yahoo</td>
<td>17%</td>
<td>55%</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>7%</strong></td>
<td><strong>51%</strong></td>
<td><strong>42%</strong></td>
</tr>
</tbody>
</table>

**Discussion of Attributes Ratings**

When looking at the scores across the four attributes—usefulness, currency, thoroughness, and speed—there were some consistencies in how the resources were rated (see Figure 32). The total percentage for “not at all” for all attributes averaged between
plus or minus 4% around the mean. However, resources for the attribute, usefulness, received the highest rating in the category, “not at all.” This may be due to the perceived value of usefulness as compared to the other attributes.

When removing the ratings for the attribute, usefulness, the total ratings for currency, thoroughness, and speed for “not at all” averaged plus or minus one percentage point around the mean. In other words, the rating, “not at all” did not vary appreciably across three of the four attributes. Physicians may not have perceived the resources as lacking currency, thoroughness, or speed to such a degree that the resource was not a viable tool.

Usefulness, currency, thoroughness, and speed received fairly consistent totals for “somewhat,” with an average of plus or minus three percentage points around the mean. A five-point scale might have forced physicians to indicate whether a resource was on the positive or negative side of the middle. The stronger modulations between “not at all” and “very” implied that, unless a resource was seriously flawed or outstanding, it would most likely be rated “somewhat.”

The most variation across the attributes was in the “very” range. Scores varied by plus or minus 6% around the mean. Eliminating the attribute, usefulness, rendered a variation of plus or minus 4% around the mean for currency, thoroughness, and speed (see Figure 32).
Even with some consistencies across the scores of the attributes, the variations within attributes for each resource fluctuated between “not at all” and “very,” with “somewhat” remaining the same. (See Figures 28-31). Even UpToDate varied by 9% within the “very” ratings across attributes. The variations were encouraging to see because physicians did not simply rate a resource consistently across all the attributes, but did acknowledge differences.

When compared to the frequency of resource use (see Figure 6), the ratings of attributes bear out that the category, “somewhat,” was not indicative of use. If a resource has a high percentage score in “very,” for the most part, the high scores are the resources that are most used. There were some exceptions: Paper was rated sixth for “very” in
currency. Micromedex and paper were rated sixth and seventh in “very” for thoroughness. MEDLINE was rated sixth for “very” in speed. If a resource received a high percentage for “not at all,” it was indicative of a resource that was not used by all the physicians.

**Discussion of Attributes and Usage of Resources**

The attribute rating, “very,” correlated closely with the choice of the top five resources for subject searches. Comparison of how often the resources were chosen (see Figure 6) and the attribute ratings of resources as very useful, thorough, current, and fast, varied by plus or minus 6% with the exception of UpToDate, which varied by 14% between usage and the overall attribute ratings (see Figure 33).

Ultimately, resource rating did not definitively identify why the same five resources were used in almost the same sequence. Google was rated as very useful (40%), very current (39%), very thorough (28%), and very fast (47%). Other resources did as well. Scores for paper, ePocrates, and eMedicine were all similar (see Figure 34).

Despite UpToDate’s rating as the most selected resource, the variation between the top five resources’ attribute rating, “very,” was plus or minus 5% around the mean. Regardless, UpToDate was used approximately twice as often (31%) as other resources. As mentioned earlier, UpToDate’s easy interface, mimicking Google with one search box, may over-shadow qualities offered by other resources. The attributes rated “very” for Medscape, MEDLINE, paper, and Micromedex (with UpToDate eliminated as an outlier) varied, at most, by 4% from the mean. The top five resources ratings for “very” were compared to their usage rank. The ranking order of resources, UpToDate,
Medscape, MEDLINE, Micromedex, and paper coincided with the rank order of attributes by “very.”

Figure 33. Times a resource was rated very useful, current, thorough, or speedy.

The success rating of 76-100% for these resources varied their rank, with UpToDate first; Micromedex rated second; Medscape, third; MEDLINE, fourth; and paper, fifth (see Tables 14 and 15). As Micromedex is used for straightforward questions (drugs and medication), this shift in rank order is reasonable. The top five resources were averaged as rating the highest across attributes.
Figure 34. Physician ranking of resources by attributes.

Although the attribute rankings imply that physicians perceive the differences in each resource, the same resources are used consistently in almost the same order. Physicians may have responded to a question that asked them to rate differences in quality because the question implies there are differences in quality. It would seem that physicians would rate their favorite resources as most capable. Their perceptions of highly rated attributes could be influenced by preference. The top five resources were rated and used in consistent order. This implies that physicians did not use the top five resources as if there was a significant difference among them. Rather, they used them in the same way. Although, when directly questioned regarding differences across resources
the physicians indicated variations in ratings, usage patterns proved the hypothesis that physicians perceived all electronic resources as being equally current and thorough.

**Physician Comments**

Thirty-six physicians made comments at the end of the survey (see Appendix J). Of those, three noted that they had no comments. Four physicians mentioned using drug representatives or companies for information. Another three mentioned Sermo, a social networking site for physicians. Physicians can post comments and vote on the comments made by their colleagues. As social networks become more popular, physicians may use 21st century technology to re-create the collaborative network that was so important to physicians before the advent of EBM.

Three physicians indicated that they still used paper resources, and five mentioned professional association sites. Seven commented that they use various technologies, including Twitter, e-mail, or instant messaging. One physician reported that, as a new physician in a group practice, she often finds herself training older physicians to navigate the Internet. Information literacy has obviously become a necessary skill for physicians. It was an indication of physicians’ attention to technology that nine commented that the survey was interesting with three expressing interest in the results.

**Issues Identified with Questionnaire Design**

The questionnaire was designed to probe answers to each question in an attempt to drill down to significant detail. The granularity of the questions resulted in numbers
that were not sufficient to allow for more complex statistical analysis. The questionnaire should eliminate the levels of choices physicians had to make.

During the completion of the research proposal, WebMD purchased Medscape and eMedicine, but kept the entities separate. After this questionnaire was designed and e-mailed to the subject group, the eMedicine Web page was changed for a closer shared interface with Medscape. Although these two resources do cross-reference each other, it was decided to leave the two resources separate. The perception of the resources was so widely divergent that it appeared physicians were unaware that these resources shared information. Where there is no difference between shared resources, e.g., the drug database shared by both, this was reported with the analysis.

**Summary**

The findings presented in this chapter supported hypotheses one and two but rejected hypothesis three:

Hypothesis one: Physicians perceive all electronic resources as being equally current and thorough was corroborated by the data. The attributes’ ratings implied that physicians saw the resources as different, but in practice, physicians used the same resources in almost the same order. This behavior persistent even when only 50% of physicians perceived success with their results at 76-100%.

Hypothesis two: Physicians think each resource has the same level of functionality was also corroborated as true. The top five resources were used almost exclusively, with UpToDate being used twice as much as other resources. Like many searchers, physicians may go first to the resources they are most familiar with and then
look elsewhere if they believed the information was inferior or incomplete. This strategy might explain the rating of the resource attributes, but would not explain the selection of the same resources for each question. The consistent use of one resource, UpToDate, for every question, illustrated a disconnection between the perceived attributes and the capabilities of the resources.

Hypothesis three: Physicians are satisfied with the results of their research whether or not they have used the most effective resource, was not substantiated by these results. A review of the resource choices for each subject area showed no consistent agreement between the percentages of physicians who used the correct resources and their perceived success, with physicians, in some cases, judging themselves less successful even when they had been using effective resources.
Chapter 5

Conclusions, Implications, Recommendations, and Summary

Conclusions

This study was performed to investigate whether physicians understood the differences among the array of resources presently available to them. Electronic resources that use a variety of interfaces and provide different categories of information are offered to physicians (Cochrane Collaboration, 2007; eMedicine, 2008; ePocrates, 2009; MDConsult, 2007; Thompson Micromedex, 2009; Medscape, 2009; UpToDate, 2007; U.S. National Library of Medicine, 2002a). It can be difficult for physicians to grasp the differences among these choices (Chumley, Dobbie, & Delzell, 2006; Cullen, 2002; Linton, Wilson, Gomes, Abate, & Mintz, 2004; McGowan & Berner, 2004).

The goal of this research was to identify the efficacy of physician information seeking behaviors by investigating three hypotheses:

1. Physicians perceive all electronic resources as being equally current and thorough.

2. Physicians think each resource has the same level of functionality.

3. Physicians are satisfied with the results of their research whether or not they have used the most effective resource.
To accomplish this, 200 physicians were randomly sampled from a population of 480 family practice physicians in Connecticut. The total population was comprised of 358 (75%) males and 122 (25%) females. The response from the random sample resulted in 90 responses—68 males (76%) and 22 females (24%) (see Table 4).

Demographic data was collected to identify differences among the subject groups’ demographics that might affect their responses. Male and female physicians were found to have no significant differences in how many times they searched, satisfaction with search results, subject areas of interest, or the resources selected. Five of the subjects were residents—four males and one female, and their responses corresponded with the larger physician group.

The average age of the subject group was 45 (see Table 1). The only significant difference among the age groups was that physicians 51 years or older were significantly less likely to rate their satisfaction as high. The lower satisfaction with search results for those 51 years or older may be due, in part, to the users feeling less comfortable with the technology. Males were slightly more likely than females to rate their satisfaction as high (see Table 3).

Males and females searched, on average, the same number of times per month. Physicians who searched 31 times or more per month self-reported a higher level of satisfaction with their results. Overall satisfaction with search results and self-perception of search skill were closely aligned (Tables 3 and 4). The majority of physicians (56%) were somewhat satisfied with their search results, and 64% rated themselves as somewhat experienced searchers. A five-point scale might have revealed a more accurate report of their satisfaction or confidence, allowing subjects the option of indicating a positive or
negative rating. A lack of confidence in results is exhibited later when resource choices are compared to perceived success (see Table 7).

Although a higher level of satisfaction is reported in the literature (Haynes, Johnston, McKibbon, Walker, & Willan; 1993; McGowan & Berner, 2004; Scott, Schaad, Mandel, Brock, & Kim, 2000), participants in older studies did not have as many resources from which to choose. In addition, the subjects from more recent studies were comprised predominantly of residents who may be more confident with computers.

Physicians were asked to rank subjects and choose information resources they would use to find information on those subjects. Staying current was the predominant area of interest, followed by CME, drug or medication questions, clinical questions, support role, research, and EBM. Gender selection of subjects was almost identical with the largest discrepancies being for drug or medication questions and staying current, differing by 6% and 7% respectively (see Figure 3).

The subjects of interest presented a coherent picture of physicians’ information needs. Staying current is challenging in the medical profession, and its importance is undisputed, but it is also acknowledged as extremely challenging (Alper, Hand, Elliott, Kinkade, Huanan, Onion, et al., 2004). However, it appears that 66% of physicians spent no more than 15 minutes reviewing information for this important subject (see Table 9). Since 60% had selected resources that were not effective, it is not surprising that only 54% reported perceived success of 76-100%. These poor results are unnecessary considering the technology now available. There are excellent resources to assist physicians with staying current, including automatic alerts through PubMed and RSS feeds from journals.
CME is mandatory for licensure, which makes staying current compulsory. Although 77% chose appropriate resources, only 50% perceived their results as successful (see Table 7). It would take some additional questioning to establish why these numbers were discrepant. If physicians were not satisfied with their results, they may not have known how to use CME online effectively or how to find the CME courses most relevant to their specialty. If they are not successfully completing CME activities, the problem could be a need for other resources. Time reported by 62% of physicians was 15 minutes or less which could affect the success of testing. Physicians should be aware that their professional organizations’ Web sites and many specialty journals have CME components. UpToDate and Medscape, the two most popular resources, offer CME, which should certainly obviate the lack of confidence demonstrated by the physicians’ responses.

Drug and medication questions can involve searching for many different problems, including diagnosis (adverse effects, allergies, concomitant drug use) or treatment. The literature emphasizes the serious consequences of inadequate drug and pharmaceutical information (Mathews, 2005; Perkins, 2001; Ramsay, 2001). For this reason, it is incredible that, with only 47% reporting success of 76-100%, 62% of physicians used resources for less than 15 minutes, and 18% of those for 1-5 minutes. Resources such as ePocrates and Micromedex have tabbed lists of prescribing information, drug interaction warnings, adverse reactions descriptions, and dosage calculators. Drug questions can be answered with a much higher degree of accuracy that reported by these subjects.
Clinical questions can occur at any time: during the patient’s visit, at a hospital bedside, or when reviewing cases at the end of the day. The information found for this subject area assists in establishing a care regimen. It is disturbing that 40% of physicians perceived their success at 76-100%. The dissatisfaction with their results for clinical questions may have been caused by time limitations, as 78% reporting using resources for 15 minutes or less. In addition, physicians relied primarily on UpToDate (27%) and MEDLINE (23%) to find information (see Figure 18). Although both resources are useful for clinical questions, UpToDate is limited in content and interface. MEDLINE is complex. With only 15 minutes dedicated to finding an answer, success is dependent on the difficulty of the question and whether or not it can be answered within a reasonable amount of time. As 88% of physicians reported they had access to a medical library, this would be the moment to contact an information professional. Time management involves knowing when to use services that are provided for this level of assistance.

Information to support teaching roles and research was not indicated as a high need by most physicians because, even if instructing or researching, staying current and CME would still have higher importance for licensure. That having been said, finding information to support instruction is an involved process, and a thorough instructor might not feel completely satisfied as more information can always be used. This may account for only 45% reporting 76-100% success although 70% had used the correct resources (see Table 7). This would be another opportunity to use an information professional, such as a medical librarian, to accrue the necessary materials.

Research requires more involvement with information resources. As 79% of physicians spent 15 minutes or less with the resources, it is difficult to imagine how 75%
of this small sample of physicians (n=10) could rate their satisfaction at 76-100% (see Table 9). MEDLINE is an excellent research tool, and has built-in features to focus searches, and Boolean searches can be performed to further narrow results. An information professional could assist in this process, or PubMed has tutorials for searching MEDLINE and other databases available on its Web site.

The low interest in EBM was disappointing given the important role it serves in assuring good care (ACGME, 2008; Chumley, Dobbie, & Delzell, 2006; Friedland, 1998; Haynes & Wilczynski, 2004). It is possible that physicians assumed that the resources they were choosing were evidence based. MEDLINE offers search aids that will limit searches to evidence-based information. The Web offers connections to the best government-sponsored sites, including the U.S. Agency for Healthcare Research and Quality (2006). The most important piece of information literacy for this subject area is to know what comprises EBM and how to ascertain whether a resource is evidence based.

Physicians had the most difficulty selecting effective resources for staying current—the topic selected by the most physicians. Inversely, over two thirds of physicians selected the correct resources for CME. In both cases, however, physician satisfaction was approximately 50%. It appeared that the resource selection had little effect on the perception of success (see Table 7). Users’ perception of success when looking for information for the top five subject areas was moderate, even when correct resources were used.

Physicians consistently used the same resources in almost the same sequence, regardless of the difference in the information sought. This self-reported satisfaction coincided with the information found in Table 3, where only 39 (43%) of physicians
rated themselves as very satisfied overall with their search results. These results reject the hypothesis that physicians are satisfied with the results of their research, whether or not they have used the most effective resource. When the subject areas, research, and EBM were dropped as outliers because of the small subject response, 47% rated their searches as successful 76-100% of the time. This suggests that physicians’ lack of understanding of what the resources are designed to do could be negatively affecting their level of satisfaction.

Table 7 contains an overview of the efficacy of resources selected compared to the desirable outcome of 76-100% perceived success with search results. The perception of success did not coincide with the effectiveness of the resources used. Perceived success of resources revealed that the top five resources varied by, at most, an average of 5% from the mean. As shown in Table 11, while UpToDate was selected twice as often as other resources, it was perceived only as successful 76-100% by 55% of physicians. On average, the top five resources only were rated successful 76-100% by 50% of physicians.

As discussed in the literature, physicians have self-reported satisfaction with the results of the information they found regardless of the quality of the results (Haynes, Johnston, McKibbon, Walker, & Willan; 1993; McGowan & Berner, 2004; Scott, Schaad, Mandel, Brock, & Kim, 2000). All the resources have information to offer. It did not appear, from the data collected in this study, that the difference among resources was distinct. This corroborates, in part, the hypothesis that physicians think each resource has the same level of functionality.
The attributes, usefulness, currency, thoroughness, and speed, were rated for each of the ten resources used throughout this study by the categories, “very,” “somewhat,” and “not at all.” The category, “somewhat,” was meaningless when gauging use of resources, with 50% of each resource, on average, being rated “somewhat.” Not surprisingly, “not at all” scores indicated low use, and “very” scores indicated high use of resources.

Resources were rated independent of a particular subject area for the attributes, usefulness, currency, thoroughness, and speed. Although ratings varied for individual resources, the search behaviors of physicians did not. The top five resources were rated most successful and were rated the highest, regardless of their appropriateness to supply information for a particular subject. Ultimately, attribute ratings did not definitively identify why the same five resources were used in almost the same sequence.

Google was rated as very useful (40%), very current (39%), very thorough (28%), and very fast (47%). Other resources did as well. Scores for paper, ePocrates, and eMedicine were all similar (see Figure 34). The reported use of Google and other search engines was unexpectedly low. This may be due, in part, to reluctance to report the use of resources that are not exclusively medical. Perhaps Google or other search engines were consulted first, but were not used as the primary resource from which physicians gather information. The persistent average of approximately 50% rating each resource as moderate implies that physicians perceive all electronic resources as being equally current and thorough.
Implications

It is apparent from the results of this research that physicians did not understand the differences among resources. Resources that were not capable of meeting information needs were still rated as providing successful answers 51-75%, by 36% of physicians, and 51% of physicians perceived their success as being between 76-100% (see Tables 7 and 13). The top five resources were compared to their rating for 76-100% perceived success. The perceived-success rating for each resource varied by, at most, an average of 5% from the mean of 50%, implying that these resources were perceived as analogous. This resulted in the acceptance of hypotheses one and two.

The self-rated satisfaction and perceived success did not agree with physicians’ overall satisfaction with their searching abilities reported in the literature (Haynes, Johnston, et al., 1993; McGowan & Berner, 2004; Scott, Schaad, Mandel, Brock, & Kim, 2000). These studies claimed that physicians were satisfied with their results regardless of the accuracy of the information they retrieved. This discrepancy might be due, in part, to this study’s question design that allowed physicians to indicate if the perceived their search as “somewhat” successful. Other studies did not ask physicians to weigh their level of satisfaction. As demonstrated here, even when the effective resource is used, physicians are unsure of their results. For this reason, hypothesis three was rejected.

For physicians to be literate consumers of information, they must be able to evaluate resources using their own base of knowledge, combined with what they have learned in practice, and complemented by new information as it enters their field. Since physicians face severe time constraints, it is particularly important that they know the most efficient resource and methodology to find the most effective answer. However, the
data showed little variation between resource use, subject area, and a limited amount of time spent pursuing information. Time limitations are an important limiter, as physicians need more than the time to find the information, but also the time to review the information found.

The selection of resources for subject searching, the time spent in each resource, and physician satisfaction with results compared with the efficacy of resources selected implies that physicians are unaware of the functionality and limitations of these resources. Physician ambivalence, as expressed by the comparison of satisfaction with search results and the efficacy of the resources selected, demonstrated that physicians would benefit from training in information literacy.

Koonce, Giuse, and Todd (2004) noted that EMIPs are becoming ubiquitous, and they warned, “users may discriminate among resources and ignore strengths and weaknesses in favor of convenience” (p. 410). As the resource choices demonstrated here, EMIPs are popular products. Their features allow busy physicians to find information quickly, a highly desirable trait. Information literacy training could make physicians effective and confident users, who can find the source that will quickly find the right answer, understand when a question needs more in-depth investigation, and partner with information professionals to extend their reach into medical information.

**Recommendations**

When confronted with a new resource, physicians do not have the basic knowledge to assess the resource and comprehend how it works. As new technologies appear in healthcare, physicians need a model to help them understand the commonalities
of resources and follow new technological developments. As the time spans did not vary dramatically across resources or subjects, it would seem that the physician’s availability drives the amount of time spent with research, not the topic, or the resource. This certainly has implications for information literacy instruction. Not only should resource functionality be taught, but also time management, i.e., how to judge the complexity of a question and when to involve an information professional.

Appendix K provides an outline of skills necessary for the development of a model for basic information literacy. This model would provide schools, CME developers, and professional organizations with consistent goals in information literacy for physicians. Achieving these goals would arm physicians with the basic skills needed to understand the core concepts of electronic information. Training physicians on specific databases has been done in the past; and, even if successful, only teaches physicians to use that particular resource effectively. A consistent methodology for including information literacy in the medical curriculum and CME is needed.

The core resources for information literacy developed by other organizations and educational institutions have provided the basis for this plan (American Library Association, 1989; Association of College and Research Libraries, 2000; Simmons College, 2005). These efforts have been combined with the knowledge gaps that have been identified in the investigation performed by this researcher. The model is designed to provide a consistent approach to the education of physicians and to give them a vision of information as a complete entity, with attributes that can be found across the array of information sources and the standards that should be expected as an essential component of quality information.
In the quest to create more information-literate physicians, it is important to remember that medical information is not yet paperless. As demonstrated in this study, paper resources are still used. Although the larger, well-known medical texts are available electronically, smaller, more specialized texts are not. In addition, electronic texts are expensive and either must be purchased outright or accessed through a subscription. Some e-book access must be renewed on a yearly basis or new editions purchased the same as printed books. Although medical libraries can afford at least a core electronic collection of the standard texts in specialties, only the largest libraries can offer all electronic medical books. For this reason, any plan for information literacy in medicine should include education on when to consult paper resources as part of the information-seeking process.

The schedule for residents and physicians is already hectic, and, for this reason, information literacy must be incorporated into the learning experience for residents and made available through CME courses. The ability to offer CME online would allow physicians to learn these skills at their convenience. For residents already involved in full programs, the model will need to be parsed into segments so that the concepts can be folded into the clinical experience.

**Recommendations for Additional Research**

The research performed for this study was limited to family practice physicians in Connecticut. It is likely that the responses to this questionnaire would vary considerably across other geographic areas. Connecticut is a small state, which boasts several medical centers with teaching facilities located in close proximity. Administering this
questionnaire in rural states and in states without the considerable resources of institutions such as Yale University could provide a more detailed analysis of physicians' information literacy needs.

This questionnaire was administered to only one medical specialty—family practice physicians. Other specialties may have more emphasis on research or rely more heavily on computers for information. It would be valuable to know if there are literacy variations across medical specialties or if information needs vary across specialties.

The sample used in this research was not large enough to identify definitively differences in age and gender definitively, and further study might reveal differences in the approach to information used by these groups that was missed in this study. Although much research has been done on medical residents and their preferences when using resources, there are no studies that identify if medical residents understand the differences among the resources they are using. Students entering residency programs may be evaluating resources based on the information assumptions learned from using Google and Wikipedia, and most practicing physicians are probably self-taught. Further research in this area is needed to identify the perceived skills and comprehension of residents and physicians who self-report as experienced searchers.

In the comments section (see Appendix J) physicians mentioned pharmaceutical companies as a source of information. More information on this source of information would be valuable as input from manufacturers of these drugs may present biased information. It would also be valuable to know what need is filled by pharmaceutical representatives. It would be valuable to know why some physicians choose to use
pharmaceutical companies for their information rather than the resources that are available.

Finally, the model described in Appendix K would benefit from studies that identify the need for additional modules to augment the teaching model proposed here. Study is needed to design and assess the most effective methods of including information literacy instruction in existing educational programs. It will be a challenge to design modules that will complement instruction in residency without adding to the already enormous workload that residents must carry. CME modules will need to be developed for practicing physicians to add value to their daily practices.

Development of a model for teaching information literacy will require ongoing research. Since many decisions that affect patient care are made using information found in electronic resources, information literacy can positively affect the quality of medicine. Patients have the right to expect their physicians to be up to date in their fields of medicine. Information literacy will enable physicians to update and expand their knowledge continuously, improving care while reducing errors in treatment.

Summary

The literature search for this research documented the importance of information literacy for physicians and revealed a lack of adequate investigation into this subject. The dire consequences of physician errors caused by incomplete or incorrect literature searches demonstrate the need for more thorough training in this area (Bor & Pelton, 2001a; Johns Hopkins University, 2001; Crocco, Villasis-Keever, & Jadad, 2002). The
research reported here confirms the need for training to provide physicians with a broader view of resources that will enable them to vet and appropriately use information products.

Although physicians are offered training on individual databases by some institutions (Ebbert, Dupras, & Erwin, 2003) and more sophisticated EBM training by other institutions (McGowan, & Berner, 2004), there is no consistent standard of what comprises an effective skills toolbox for physicians who must cope with a daily influx of information. Information specialists, teaching physicians, and professional organizations need to update their educational programs to facilitate the learning of this essential skill set. The very nature of medicine demands continued, rigorous tracking of information. Information literacy—the ability to find and apply the most current information—is an essential skill that should be folded into medical practice in every specialty.
Appendix A

Acronyms

AAHRPP: Association for the Accreditation of Human Research Protection Programs

AAMC: Association of American Medical Colleges

ACGME: Accreditation Council for Graduate Medical Education

ACRL: Association of College and Research Libraries

ALA: American Library Association

AMA: American Medical Association

AMS: Adaptive Management Strategies, Inc.

CME: Continuing medical education

CMO: Chief Medical Officer

CPG: clinical practice guidelines

EBM: evidence-based medicine

EMIPs: electronic medical information products

EPC: Evidence-based Practice Center

FIT: Fluency in Information Technology

IOM: Institute of Medicine

IRB: Internal review board

MEDLARS: Medical Literature Analysis and Retrieval System

MeSH: Medical Subject Headings

MLA: Medical Library Association

MSOP: Medical School Objectives Project
NAS: National Academy of Sciences

NLM: U.S. National Library of Medicine

NRC: National Research Council

OHRP: Office for Human Research Protections

PBL: Problem-based learning
Appendix B

Questionnaire


National Library of Medicine
8600 Rockville Pike
Bethesda, MD 20894

INSTRUCTIONS: The purpose of this questionnaire is to find out how individuals use MEDLINE on the National Library of Medicine computer system, their level of satisfaction with the system, and their views on how it can be improved. The NLM hopes to use this information TO PROVIDE BETTER SERVICE TO ITS USERS. Unless otherwise indicated, answer each question by either writing your answer in the space provided or by circling the number in front of the appropriate answer. All your answers will be available only to the study investigators, unless otherwise required by law. If you have any questions about this study, please contact Karen Wallingford at (302) 496-3261.

SECTION I. GENERAL INFORMATION

1. What is your profession? (*Circle all that apply*)
   1. Physician
   2. Nurse
   3. Other Health Professional
   4. Scientist
   5. Student
   6. Librarian/Information Specialist
   7. Other (specify) __________________________________

2. What is the highest educational degree you hold? _______

3. What year did you receive that degree? _______

4. If you are a health professional, what is your specialty? (*If you are not a health professional, please skip this question.*) __________________________
5. What is your primary work space? *(Circle only one answer)*
   1. Private solo practice
   2. Group practice
   3. College or university or medical school
   4. Hospital or clinic
   5. Private company or business
   6. Government agency
   7. No formal work place (i.e., student or otherwise unaffiliated)
   8. Other (specify) _______________________________________

6. Do you have a microcomputer (PC) or is one available in your work place?
   a. No
   b. Yes, type: ____________________________

7. How many people (including yourself) share the MEDLINE User ID Code you use? *(If you are the only person who uses this code, please write “1”).
   _____user(s)

8. How many MEDLINE searches do you do on the NLM computer in the average month? *(Do not include searches done for you by someone else).* ______searches

9. How many MEDLINE searches do you have someone else do for you in the average month? *(If you do all of your searches, enter zero and skip to question 11).* ______searches

10. If other people occasionally or always search MEDLINE for you:
    i. Who generally does the searches for you? *(Circle only one answer)*
       1. Librarian/Information Specialist
       2. Student/Research Assistant
       3. Secretary/Administrative Assistant
       4. Colleague
       5. Family Member
       6. Other (specify) ________________________________
    
    ii. Under what circumstances do you prefer to have someone else search MEDLINE for you? *(Circle all that apply)*
        1. When someone else can do it as easily as I can
        2. When I don’t have time to do it myself
        3. When I need different expertise/system knowledge
        4. When I’ve tried a search myself and have not been satisfied with the results
        5. Other
           *(specify)_________________________________________________
           ___________________________

Please rate how satisfied you generally are with searches you do yourself, and searches that are done for you by others. *(If you never search MEDLINE yourself, please leave that response blank).*

<table>
<thead>
<tr>
<th>Searches done by</th>
<th>Very Satisfied</th>
<th>Not At All Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>1. Yourself</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. Others</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

iii. If you are generally not satisfied with MEDLINE searches done for you, (if you circled 4 or 5) please indicate why. *(Circle all that apply)*

1. Inconvenient location
2. Inconvenient hours
3. Have to wait to get search done
4. Cost
5. Unsatisfactory results
6. Other (specify) ____________________________________________

IF YOU NEVER SEARCH MEDLINE YOURSELF, DO NOT FILL OUT THE REST OF THIS QUESTIONNAIRE. PLEASE RETURN IT IN THE ATTACHED POSTAGE PAID ENVELOPE. THANK YOU FOR YOUR COOPERATION. IF YOU DO SEARCH MEDLINE YOURSELF, PLEASE COMPLETE THE REST OF THE QUESTIONNAIRE.

SECTION II  SYSTEM USE

11. What factors influence you to search online databases yourself, instead of having someone else do the search for you? *(Circle all that apply, and check the single most influential factor).*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Influential Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>_____ I am more familiar with the subject matter than a search intermediary</td>
</tr>
<tr>
<td>2.</td>
<td>_____ I get the information faster</td>
</tr>
<tr>
<td>3.</td>
<td>_____ I enjoy searching</td>
</tr>
<tr>
<td>4.</td>
<td>_____ It’s more cost effective than using a search intermediary</td>
</tr>
<tr>
<td>5.</td>
<td>_____ No one else is available to do the search for me</td>
</tr>
<tr>
<td>6.</td>
<td>_____ Other (specify) ________________________________</td>
</tr>
</tbody>
</table>
12. How experienced a user of online databases do you consider yourself to be?
   a. Very experienced
   b. Somewhat experienced
   c. Not very experienced
   d. Not at all experienced

13. How long have you been searching MEDLINE on your User ID code?
    _____ years    _____ months

14. During the time you have been searching, would you say that your use of
    MEDLINE has
   a. Increased
   b. Stayed about the same
   c. Decreased

15. If your usage has increased or decreased, please indicate the reasons for the
    change.
    _____________________________________________________________
    _____________________________________________________________
    _____________________________________________________________
    _____________________________________________________________

16. How often do cost considerations keep you from doing a MEDLINE search on the
    NLM computer?
   a. Never
   b. Rarely
   c. Occasionally
   d. Frequently

17. How would you rate your overall satisfaction with MEDLINE on the NLM
    computer system?

    | Very Satisfied |   |   | Not at all Satisfied |
    |----------------|---|---|---------------------|
    | 1              | 2 | 3 | 4                   | 5
SECTION III. MEDLINE SEARCHES

18. When you search MEDLINE…
   i. Is it typically for (Circle only one answer)
      1. An immediate information need
      2. Staying current in your field
      3. Learning about new areas
      4. Other (specify) _________________________________
   
   ii. Are you typically interested in retrieving: (Circle only one answer)
      1. Just a few relevant citations
      2. All relevant citations from a particular time period
      3. Other (specify)
   
   iii. Do you typically retrieve: (Circle only one answer)
      1. Too few citations
      2. About the right number of citations
      3. Too many citations
   
   iv. What percent of these citations are typically relevant to your inquiry? ______%

19. When you search MEDLINE, do you most often search for: (Circle only one answer)
   a. an author
   b. a journal title
   c. a subject

20. Please indicate the primary areas in which you use MEDLINE search information, rank ordered so that you’re most common use is #1, second most common is #2, etc. Please give no more than three answers.
   _____ Patient Care
   _____ Education
   _____ Research/Testing
   _____ Management/Administration
   _____ Regulation
   _____ Other (Specify) _________________________________

21. How often do you use the Medical Subject Headings (MeSH) terms when searching for specific subjects?
   a. Always
   b. Usually
   c. Occasionally
   d. Rarely
   e. Never
22. How useful do you find the MeSH terms to be?

<table>
<thead>
<tr>
<th>Very Useful</th>
<th></th>
<th>Not at all Useful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

23. If you think the MeSH terms are generally not useful, or if you never use MeSH terms, please indicate why.
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

24. How long does it typically take you (at the terminal or microcomputer) to search MEDLINE on the NLM system for citations on a particular subject?
   a. Less than 5 minutes
   b. 5 to 10 minutes
   c. 10 to 15 minutes
   d. More than 15 minutes

25. Do you feel that this is:
   a. Too long
   b. A reasonable amount of time
   c. Quicker than expected

26. Are there any types of information that would be valuable to you that you cannot routinely find in a citation?
   a. No (Skip to question 27)
   b. Yes… (Please circle all of the following types of information that would be valuable to you, and check the single most valuable type of information).

   Valuable                        Most Valuable
   1. _____ Author address
   2. _____ Dosage Information
   3. _____ Research design
   4. _____ Journal section (i.e., Brief Communications)
   5. _____ Full text article
   6. _____ Other (specify) __________________________
27. Which of the following features or capabilities would you most like to see added to the NLM system? (Circle as many as you like, and check the one feature you would most like to see).

<table>
<thead>
<tr>
<th>Wanted</th>
<th>Most Wanted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _____ Ability to sort citations online</td>
<td></td>
</tr>
<tr>
<td>2. _____ Improved capability for selecting which citations to print</td>
<td></td>
</tr>
<tr>
<td>3. _____ Ability to sort citations among different databases</td>
<td></td>
</tr>
<tr>
<td>4. _____ Improved capability for searching MEDLINE Backfiles at one time</td>
<td></td>
</tr>
<tr>
<td>5. _____ Improved methods for SDI (automated monthly update search) service</td>
<td></td>
</tr>
<tr>
<td>6. _____ More non-English literature indexed</td>
<td></td>
</tr>
<tr>
<td>7. _____ More “didactic” (i.e., educational/instructional/teaching, etc.) literature indexed</td>
<td></td>
</tr>
<tr>
<td>8. _____ Ability to specify the “adjacency” of searched Text Words</td>
<td></td>
</tr>
<tr>
<td>9. _____ Other (specify)</td>
<td></td>
</tr>
</tbody>
</table>

SECTION IV. ACCESSING MEDLINE

28. When you search MEDLINE, do you primarily use:
   a. A microcomputer (PC)
   b. A terminal

29. Please write in the percent of MEDLINE searches you perform with each of the following methods. Note that your percents should add up to 100. (If you do not use a method, please write “0”).

   _____ % Direct/command language (no user-friendly front-end)
   _____ % GRATEFUL MED, using form screens
   _____ % GRATEFUL MED, using option 3, direct mode
   _____ % Other user-friendly front-end package (specify)_________________

100% Total

30. If you use more than one method of searching MEDLINE, under what circumstances do you choose one method over another?

________________________________________________________________________
________________________________________________________________________
31. What types of problems, if any, do you have accessing the NLM computer? 
(Circle all that apply)
   a. No problems
   b. Remembering connect/disconnect protocols
   c. Busy telecommunication lines
   d. NLM computer not available
   e. Other (specify) ______________________________________

32. How did you learn to search MEDLINE on the NLM computer system? (Please circle all the methods that you used, and check the one method that was the most helpful to you in learning how to search MEDLINE).

<table>
<thead>
<tr>
<th>Used Method</th>
<th>Most Helpful</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. _____ Using GRATEFUL MED</td>
<td></td>
</tr>
<tr>
<td>2. _____ Using other front-end software (e.g., SCI-MATE)</td>
<td></td>
</tr>
<tr>
<td>3. _____ Attended NLM-sponsored training course</td>
<td></td>
</tr>
<tr>
<td>4. _____ Attended a course as part of an academic curriculum</td>
<td></td>
</tr>
<tr>
<td>5. _____ Attended other, non-NLM sponsored training course</td>
<td></td>
</tr>
<tr>
<td>6. _____ Self-taught</td>
<td></td>
</tr>
<tr>
<td>7. _____ Learned from a co-worker</td>
<td></td>
</tr>
<tr>
<td>8. _____ Other (specify) ______________________________</td>
<td></td>
</tr>
</tbody>
</table>

33. If you have attended an NLM-sponsored training course (choice 3 in question 32), please circle the course(s) you attended, and how satisfied you were with the course(s).

<table>
<thead>
<tr>
<th>Attended?</th>
<th>Very Satisfied</th>
<th>Not at all Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 3-5 day Initial Training Course</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2. 6-hour Basics of Searching MEDLINE</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

At some future point the NLM may conduct additional research on topics related to MEDLINE and the MEDLINE search system. Would you be willing to participate in a follow up study?

1. Yes ((Please fill out your name, address and phone number below).
2. No

   Name: ________________________________
   Address: ________________________________
   ________________________________
   Phone: ________________________________
If you have any additional comments that you would like to make about MEDLINE, please do so in the space below. We are particularly interested in knowing those aspects of MEDLINE with which you are most satisfied, and those aspects of MEDLINE with which you are least satisfied. Please continue on the back of this form if you need additional space.

Most Satisfactory Aspects:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Least Satisfactory Aspects:
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Please return this survey in the enclosed postage paid envelope.

Thank you for your time and cooperation.
Appendix C

Questionnaire


This is a survey meant to help us understand how you are currently using resources and references to learn from your patients. It should not take much time for you to complete but will provide us with vital information about the skills and resources we need to help you and future students learn. Thanks for helping.

1. When you see a patient in clinic or on the wards, which one of the following resources do you use MOST often?

- Published paper textbooks
- Electronic literature search (PubMed, Ovid, etc.)
- Harrison’s OnLine
- MDConsult
- UpToDate
- Cochrane Library
- Other paper-based resources
- Other Web sites

2. For the answer to the previous question, which of the following statements BEST describes how you use the resource?

- Immediately (as you make clinical decisions)
- Some time during the day I see the patient
- In the evening in preparation for rounds or discussion the next day
- Only when I am assigned a discussion or question to research

3. For the resource identified in Question 1, how often do you use it on average?

- Daily
- More than once a week, but not daily
- Weekly
- Every month, but less than weekly
4. How long do you spend with the resource once you find the information?

☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

5. Using the resource in Question 1, what percentage of the time do you successfully get an answer to your question?

☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%

6. When you see a patient in clinic or on the wards, which one of the following resources do you use SECOND MOST often?

☐ Published paper textbooks
☐ Electronic literature search (PubMed, Ovid, etc).
☐ Harrison’s OnLine
☐ MDConsult
☐ UpToDate
☐ Cochrane Library
☐ Other paper-based resources
☐ Other Web sites
☐ I don’t use any other resources

7. For the answer to the previous question, which of the following statements BEST describes how you use the resources?

☐ Immediately (as you make clinical decisions)
☐ Some time during the day I see the patient
☐ In the evening in preparation for rounds or discussion the next day
☐ Only when I am assigned a discussion or question to research

8. For the resource identified in Question 6, how often do you use it on average?

☐ Daily
☐ More than once a week, but not daily
☐ Weekly
☐ Every month, but less than weekly
9. How long do you spend with the resource once you find the information?
   - 1-5 minutes
   - 6-15 minutes
   - 16-30 minutes
   - Over 30 minutes

10. Using the resource in Question 6, what percentage of the time do you successfully get an answer to your question?
   - 0-25%
   - 26-50%
   - 51-75%
   - 76-100%

11. When you see a patient in clinic or on the wards, which one of the following resources do you use THIRD MOST often?
   - Published paper textbooks
   - Electronic literature search (PubMed, Ovid, etc).
   - Harrison’s OnLine
   - MDConsult
   - UpToDate
   - Cochrane Library
   - Other paper-based resources
   - Other Web sites
   - I don’t use any other resources

12. For the answer to the previous question, which of the following statements BEST describes how you use the resources?
   - Immediately (as you make clinical decisions)
   - Some time during the day I see the patient
   - In the evening in preparation for rounds or discussion the next day
   - Only when I am assigned a discussion or question to research
13. For the resource identified in Question 11, how often do you use it on average?

- Daily
- More than once a week, but not daily
- Weekly
- Every month, but less than weekly

14. How long do you spend with the resource once you find the information?

- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

15. Using the resource in Question 11, what percentage of the time do you successfully get an answer to your question?

- 0-25%
- 26-50%
- 51-75%
- 76-100%

16. How do you rate the overall usefulness of each of the following resources in learning clinical medicine from your patients?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not Useful</th>
<th>Very Useful</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Published paper textbooks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic literature search (PubMed, Ovid, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harrison’s OnLine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDConsult</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UpToDate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cochrane Library</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other paper-based resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Web sites</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
17. How likely are you to use each of the following resources as you move to the next stage of your education?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not Useful</th>
<th>Very Useful</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Published paper textbooks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronic literature search (PubMed, Ovid, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Harrison’s OnLine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MDConsult</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UpToDate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cochrane Library</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other paper-based resources</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Web sites</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D
Research Questionnaire
(Formatted as a Web based questionnaire)

1. How many times do you use the computer to search for medical information in the average month?
   - □ 1-10
   - □ 11-20
   - □ 21-30
   - □ 31-40
   - □ >41
   - □ I do not use the computer to search for medical information.

   If “I do not use…” is selected, a message will be generated that states:

   “The remainder of this questionnaire asks detailed questions about computers and information seeking behavior and will not be relevant to your interests. Thank you for your assistance.”

2. Please rate your satisfaction with your search results:

<table>
<thead>
<tr>
<th>Not at all satisfied</th>
<th>Somewhat satisfied</th>
<th>Very Satisfied</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3. Please rate how experienced a user of online databases or electronic information resources you consider yourself to be.

<table>
<thead>
<tr>
<th>Not at all experienced</th>
<th>Somewhat experienced</th>
<th>Very experienced</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
The following questions will help identify the medical information you search for and the information resources that you find useful.

4. Please rank the primary areas in which you search for information. so that your most common area searched is #1, second most common is #2, third most common is #3, etc. Please rank at least three.

____ Clinical questions
____ Drug or medication questions
____ Evidence-based medicine (EBM) reviews
____ Continuing medical education (CME)
____ Information to support your role as an instructor or medical school faculty
____ Stay current in medicine
____ Research (clinical trials, presentations, publication, etc.)
____ Answers to other questions (specify

________________________________________________________________________

________________________________________________________________________

5. You have indicated that you search for answers to clinical questions. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

____ MEDLINE (through Ovid, PubMed, etc.)
____ UpToDate
____ eMedicine
____ Medscape/WebMD
____ MDConsult
____ Micromedex
____ ePocrates
____ Paper resources (book, journal, etc.)
____ Web search engines. Please specify:
      _____ Google
      _____ Yahoo
      _____ Other – Please specify:

____ Other electronic resources. Please specify:__________________________
5.a. For the resource you ranked #1 for clinical questions:

How long do you spend with the resource once you find the information?
☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%

5.b. For the resource you ranked #2 for clinical questions:

How long do you spend with the resource once you find the information?
☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%
6. You indicated that you search for answers to drug or medication questions. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

- MEDLINE (through Ovid, PubMed, etc.)
- UpToDate
- eMedicine
- Medscape/WebMD
- MDConsult
- Micromedex
- ePocrates
- Paper resources (book, journal, etc.)
- Web search engines. Please specify:
  - Google
  - Yahoo
  - Other – Please specify:
- Other electronic resources. Please specify:__________________

6.a. For the resource you ranked #1 for drug or medication questions:

How long do you spend with the resource once you find the information?
- □ 1-5 minutes
- □ 6-15 minutes
- □ 16-30 minutes
- □ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- □ 0-25%
- □ 26-50%
- □ 51-75%
- □ 76-100%
6.b. For the resource you ranked #2 for drug or medication questions:

How long do you spend with the resource once you find the information?
- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- 0-25%
- 26-50%
- 51-75%
- 76-100%

7. You indicated that you search for answers to evidence-based medicine (EBM) reviews. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

____ MEDLINE (through Ovid, PubMed, etc.)
____ UpToDate
____ eMedicine
____ Medscape/WebMD
____ MDConsult
____ Micromedex
____ ePocrates
____ Paper resources (book, journal, etc.)
____ Web search engines. Please specify:
    _____ Google
    _____ Yahoo
    _____ Other – Please specify: ___________________

____ Other electronic resources. Please specify: ______________
7.a. For the resource you ranked #1 for evidence-based medicine (EBM) reviews:

How long do you spend with the resource once you find the information?
☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%

7.b. For the resource you ranked #2 for evidence-based medicine (EBM) reviews:

How long do you spend with the resource once you find the information?
☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%
8. You indicated that you search for continuing medical education (CME). What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

- MEDLINE (through Ovid, PubMed, etc.)
- UpToDate
- eMedicine
- Medscape/WebMD
- MDConsult
- Micromedex
- ePocrates
- Paper resources (book, journal, etc.)
- Web search engines. Please specify:
  - Google
  - Yahoo
  - Other – Please specify: ____________________

- Other electronic resources. Please specify: ____________________

8.a. For the resource you ranked #1 for continuing medical education (CME):

How long do you spend with the resource once you find the information?
- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- 0-25%
- 26-50%
- 51-75%
- 76-100%
8.b. For the resource you ranked #2 for continuing medical education (CME):

How long do you spend with the resource once you find the information?
- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- 0-25%
- 26-50%
- 51-75%
- 76-100%

9. You indicated in question #5 that you search for information to support your role as an instructor or medical school faculty. Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

____ MEDLINE (through Ovid, PubMed, etc.)
____ UpToDate
____ eMedicine
____ Medscape/WebMD
____ MDConsult
____ Micromedex
____ ePocrates
____ Paper resources (book, journal, etc.)
____ Web search engines. Please specify:
   _____ Google
   _____ Yahoo
   _____ Other – Please specify:____________________

____ Other electronic resources. Please specify:__________________
9.a. For the resource you ranked #1 for information to support your role as an instructor or medical school faculty:

How long do you spend with the resource once you find the information?

- [ ] 1-5 minutes
- [ ] 6-15 minutes
- [ ] 16-30 minutes
- [ ] Over 30 minutes

What percentage of time do you successfully get an answer to your question?

- [ ] 0-25%
- [ ] 26-50%
- [ ] 51-75%
- [ ] 76-100%

9.b. For the resource you ranked #2 for information to support your role as an instructor or medical school faculty:

How long do you spend with the resource once you find the information?

- [ ] 1-5 minutes
- [ ] 6-15 minutes
- [ ] 16-30 minutes
- [ ] Over 30 minutes

What percentage of time do you successfully get an answer to your question?

- [ ] 0-25%
- [ ] 26-50%
- [ ] 51-75%
- [ ] 76-100%
10. You indicated in question #5 that you search to stay current in medicine. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
</tr>
<tr>
<td></td>
<td>UpToDate</td>
</tr>
<tr>
<td></td>
<td>eMedicine</td>
</tr>
<tr>
<td></td>
<td>Medscape/WebMD</td>
</tr>
<tr>
<td></td>
<td>MDConsult</td>
</tr>
<tr>
<td></td>
<td>Micromedex</td>
</tr>
<tr>
<td></td>
<td>ePocrates</td>
</tr>
<tr>
<td></td>
<td>Paper resources (book, journal, etc.)</td>
</tr>
<tr>
<td></td>
<td>Web search engines. Please specify:</td>
</tr>
<tr>
<td></td>
<td>Google</td>
</tr>
<tr>
<td></td>
<td>Yahoo</td>
</tr>
<tr>
<td></td>
<td>Other – Please specify:________________________</td>
</tr>
<tr>
<td></td>
<td>Other electronic resources. Please specify:________________________</td>
</tr>
</tbody>
</table>

10.a. For the resource you ranked #1 to stay current in medicine:

How long do you spend with the resource once you find the information?
- □ 1-5 minutes
- □ 6-15 minutes
- □ 16-30 minutes
- □ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- □ 0-25%
- □ 26-50%
- □ 51-75%
- □ 76-100%
10.b. For the resource you ranked #2 to stay current in medicine:

How long do you spend with the resource once you find the information?

- [ ] 1-5 minutes
- [ ] 6-15 minutes
- [ ] 16-30 minutes
- [ ] Over 30 minutes

What percentage of time do you successfully get an answer to your question?

- [ ] 0-25%
- [ ] 26-50%
- [ ] 51-75%
- [ ] 76-100%

11. You indicated that you search for research (clinical trials, presentations, publication, etc.). What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

- [ ] MEDLINE (through Ovid, PubMed, etc.)
- [ ] UpToDate
- [ ] eMedicine
- [ ] Medscape/WebMD
- [ ] MDConsult
- [ ] Micromedex
- [ ] ePocrates
- [ ] Paper resources (book, journal, etc.)
- [ ] Web search engines. Please specify:
  - [ ] Google
  - [ ] Yahoo
  - [ ] Other – Please specify: ____________________

- [ ] Other electronic resources. Please specify: ____________________
11.a. For the resource you ranked #1 for research (clinical trials, presentations, publication, etc.):

How long do you spend with the resource once you find the information?

- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?

- 0-25%
- 26-50%
- 51-75%
- 76-100%

11.b. For the resource you ranked #2 for research (clinical trials, presentations, publication, etc.):

How long do you spend with the resource once you find the information?

- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?

- 0-25%
- 26-50%
- 51-75%
- 76-100%
12. You indicated that you search for answers to other questions. What are the two resources you use most often? Please rank them #1 and #2.

- MEDLINE (through Ovid, PubMed, etc.)
- UpToDate
- eMedicine
- Medscape/WebMD
- MDConsult
- Micromedex
- ePocrates
- Paper resources (book, journal, etc.)
- Web search engines. Please specify:
  - Google
  - Yahoo
  - Other – Please specify:________________________
- Other electronic resources. Please specify:____________________

12.a. For the resource you ranked #1 for answers to other questions:

How long do you spend with the resource once you find the information?
- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

What percentage of time do you successfully get an answer to your question?
- 0-25%
- 26-50%
- 51-75%
- 76-100%
12.b. For the resource you ranked #2 for answers to other questions:

How long do you spend with the resource once you find the information?
☐ 1-5 minutes
☐ 6-15 minutes
☐ 16-30 minutes
☐ Over 30 minutes

What percentage of time do you successfully get an answer to your question?
☐ 0-25%
☐ 26-50%
☐ 51-75%
☐ 76-100%

13. How do you rate the overall usefulness of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not useful</th>
<th>Somewhat useful</th>
<th>Very Useful</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Other resources (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
14. How do you rate the overall currency of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not current</th>
<th>Somewhat current</th>
<th>Very current</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
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<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>

| Other resources (Please specify)       |             |                  |              |     |

|                                     | 1           | 2                | 3            | N/A |
|                                     | 1           | 2                | 3            | N/A |
|                                     | 1           | 2                | 3            | N/A |
15. How do you rate the overall thoroughness of information of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not thorough</th>
<th>Somewhat thorough</th>
<th>Very thorough</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
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<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
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<td>3</td>
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<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>
16. How do you rate the overall speed with which you find information in each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not fast</th>
<th>Somewhat fast</th>
<th>Very fast</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>UpToDate</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>eMedicine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>MDConsult</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Micromedex</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>ePocrates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Paper resource (book, journal, etc.)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Web search engines (Google, Yahoo, etc.) (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Other resources (Please specify)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>N/A</td>
</tr>
</tbody>
</table>

17. Are you in a residency or fellowship program?
   _____Yes
   _____No

18. Please check your age range:
   □ 20-30
   □ 31-40
   □ 41-50
   □ 51-60
   □ 61-70
   □ 71+
19. Gender:  
☑ Male  
☐ Female  

20. Do you have access to a medical library?  
☑ Yes  
☐ No  

If you wish to share any additional comments regarding your information needs or this questionnaire they would be appreciated.  

Comments:
Appendix E

Author Permission - Humphreys

----- Original Message -----
From: "Humphreys, Betsy (NIH/NLM)" <humphreb@mail.nlm.nih.gov>
To: Janice Swiatek-Kelley <jswiatekkelley@yahoo.com>
Cc: bjswia@bpthosp.org; swiatekk@nova.edu
Sent: Monday, February 7, 2005 12:32:36 PM
Subject: RE: Request to use your questionnaire--dissertation

You certainly have permission to use anything from the survey. I imagine quite a bit of it is no longer relevant, but assume you will not be using those portions.

Betsy Humphreys

----- Original Message -----
From: Janice Swiatek-Kelley [mailto:jswiatekkelley@yahoo.com]
Sent: Monday, February 07, 2005 11:40 AM
To: Humphreys, Betsy (NIH/NLM)
Cc: swiatekk@nova.edu
Subject: Request to use your questionnaire--dissertation

Dear Ms. Humphreys:

I have attached a letter and description, but have included the text of the letter here in case you are being cautious regarding unidentified attachments:

I am the director of a medical library at Bridgeport Hospital, Bridgeport, CT, Yale New Haven Health System. In addition, I am pursing a distance Ph.D. in Information Science from Nova Southeastern, Ft. Lauderdale, Florida (http://www.scis.nova.edu).

My course work is complete, and I am now working on my dissertation. I have completed the preliminary proposal and am in the process of developing the proposal. I am writing to ask for permission to use portions of the questionnaire from the "Survey of Individual Users of MEDLINE on the NLM System," from November 30, 1988. As this is a government study, I thought you would be the most appropriate author to contact.

I have included a copy of my Problem Statement and Goal. I plan to include targeted MEDLINE questions combined with questions regarding other sources. I look forward to hearing from you regarding permission and any feedback you would care to give.

Thank you for any assistance.

Janice Swiatek-Kelley, M.L.S.
Appendix F

Author Permission – Peterson

----- Original Message -----
From: Michael Peterson <MPeterson@UCSFresno.edu>
To: Janice Swiatek-Kelley <jswiatekkeley@yahoo.com>
Cc: Lori Strommer Pace (Business Fax) <IMCEAFAX-Lori+20Strommer+20Pace+40+28319+29+20384-8062@Medell.UCSFresno.edu>
Sent: Wednesday, August 25, 2004 2:13:14 PM
Subject: RE: Article published in Academic Medicine

Janice,

Thanks for your interest in our paper. The survey we conducted was done on-line. I am copying my web assistant at the time to see if she can pull you down a copy to review for your own use.

Mike Peterson
Michael W. Peterson, M.D.
VMF Professor and Chief of Medicine
UCSF-Fresno
Vice-Chair of Medicine, UCSF
phone 559-459-4390
FAX 559-459-6119

-----Original Message-----
From: Janice Swiatek-Kelley [mailto:jswiatekkeley@yahoo.com]
Sent: Wednesday, August 25, 2004 3:34 AM
To: michael.peterson@ucsfresno.edu
Subject: Article published in Academic Medicine

Dear Dr. Peterson:
I read your article in Academic Medicine with great interest. Currently I work at Bridgeport Hospital in Bridgeport CT, as part of the Yale New Haven Healthcare system. I attend Nova Southeastern University in Ft. Lauderdale, FL, through a computerized distance education program in Information Science.

I am writing my doctoral dissertation on physician use of computer-based resources in a clinical setting and found your research extremely helpful. Would you be willing to share your survey instrument with me? I believe that it would assist me in developing a survey instrument that would target a population across several health care facilities. I would, of course, acknowledge you and your co-authors as the owners of the questionnaire.

Thank you for your consideration, and I look forward to hearing from you. If you have additional questions,
I look forward to answering them.

Janice Swiatek-Kelley, M.L.S.
Appendix G

Questionnaire Validation Script

Standardized Script Conducted via Telephone

Hello, this is Jon Jenett from AMS. You have completed questionnaires for AMS in the past, would you be willing to review a questionnaire that is to be used for an online survey through AMS. We will be offering this questionnaire through our standard interface for a Ph.D. candidate at Nova Southeastern, and we would like your feedback on the questionnaire structure. Would you be willing to complete the questionnaire now and then answer a few questions?

Validation Process

If the subject consents to be surveyed, the following information will be solicited and the response recorded by the interviewer.

After completion, the following questions will be asked:

7) Do you think that the time it took to complete this questionnaire was
   a. Not too long
   b. Too long
   c. Just right

Comments:

8) Did you have any difficulty answering the questions?
   a. Yes
      i. Probe: Can you be more specific?
   b. No

Comments:

9) Did you have any difficulty identifying your information needs (question #4)?
   a. Yes
      i. Probe: Can you be more specific?
   b. No
Comments:

10) Did you have any difficulty recognizing or identifying the resource choices that applied to you?
   a. Yes
      i. Probe: Can you be more specific?
   b. No

Comments:

11) Overall, how difficult or easy was it to complete the questionnaire, if ‘1’ is very easy and ‘5’ is very difficult?

   Record number________

Comments:

**Final questions**

Are there any additional comments you would like to make about the questionnaire?

Are there any suggestions you would like to make about the questionnaire?

Are there any questions about the study that I can answer for you?

Thank you for your time. Your comments have been very helpful.
Appendix H

E-mail to Request Participation

SUBJECT: New PAID AMS consulting study open now, please REPLY to this email

Dear Dr. Jones,

We appreciate your continued involvement in AMS consulting. We have a special paid consulting opportunity we would like to invite you to participate in. It is online, will just take a few minutes of your time, and will be of real interest to you.

During the week of XXXXX, we are assisting in a study with Ms. Janice Swiatek-Kelley, a candidate for her PhD from Nova Southeastern University. She is researching how physicians such as yourself use the internet for information related to their practice, and your input will be greatly appreciated. The data gathered will be analyzed and may be published as part of her Ph.D. dissertation, and we will share the results with you. (But, of course, as always no information about you personally or your practice will be released by AMS).

If you are interested in being a paid participant in this study, please reply to this email and indicate your willingness to participate. We are limiting the number of physicians participating in this study, so a prompt response is appreciated. When you reply to this invitation by email, we will email you a validated link to the online questionnaire. Then at your convenience you can provide the required feedback (it will take about ten minutes to fill out). We will then credit your account for 15 minutes of consulting time that will show on your monthly AMS statement.

Let me know by reply email if you would like to participate and we will email your validated link. Thank you for your continued interest in our regular AMS pharmaceutical client consulting as well, we appreciate it. Please feel free to call me with any questions.

Best regards,

Jon Jenett, CEO
AMS, Inc.
949-632-4515
Appendix I

Questionnaire Screen Shots

Welcome to AMS. We arrange and schedule private, professional, courteous, and productive one-on-one meetings between pharmaceutical reps and physicians at the convenience of the physician. We ask physicians for brief opinions of your experience in that interaction and compensate you for this valuable feedback. AMS uses advanced technology and the web to schedule and facilitate this process at your convenience:

AMS offers both ON-LINE and OFFICE based (in your office) meetings (typically ten minutes in length)

The meetings are with a pharmaceutical rep for a detail about a drug relevant to your practice

AMS compensates you for providing us with candid, valuable feedback about your “physician customer experience” in that detail.

AMS was founded on a simple concept. Pharmaceutical companies (our clients) have valuable information about their drugs and enabling enhanced patient care that they want to get to physicians. Physicians tell us they DO want this information, but "on my terms at a time that is convenient for me, not thrown at me in 30 seconds while I am busy with patients." Most physicians tell us a one-on-one interaction with a well-trained rep is an excellent way to obtain such information.

Physicians tell AMS, "I know the pharma companies are trying to get me to 'write script' on their drugs. BUT they also have valuable information about their drugs that I want to use in deciding treatment modalities to enhance care for my patients. And, my feedback is valuable and I am happy that I can be compensated for providing this valuable feedback about my customer experience with the rep and the presentation."

We would appreciate your involvement and comments if you feel it is worthwhile for you. If you have any further questions please feel free to contact us directly at 949-632-4515.
**Login**

You have indicated that you search for answers to Drug or medication questions. What are the two resources you use most often? Rank your most commonly used resource as #1 and your second most commonly used resource as #2.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Resource</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ePocrates</td>
</tr>
<tr>
<td>2</td>
<td>Paper resources (book, Journal, etc.)</td>
</tr>
<tr>
<td>3</td>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
</tr>
<tr>
<td></td>
<td>UpToDate</td>
</tr>
<tr>
<td></td>
<td>eMedicine</td>
</tr>
<tr>
<td></td>
<td>Medscape/WebMD</td>
</tr>
<tr>
<td></td>
<td>Micromedex</td>
</tr>
</tbody>
</table>

Other electronic resources (please specify):

Save Answers

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**Login**

For Drug or medication questions for MEDLINE (through Ovid, PubMed, etc.): How long do you spend with the resource once you find the information?

- 1-5 minutes
- 6-15 minutes
- 16-30 minutes
- Over 30 minutes

Save Answers

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For Drug or medication questions for MEDLINE (through Ovid, PubMed, etc.): What percentage of time do you successfully get an answer to your question?

- 0-25%
- 26-50%
- 51-75%
- 76-100%

USEFULNESS: How do you rate the overall USEFULNESS of each of the following resources?

- MEDLINE (through Ovid, PubMed, etc.)
- UpToDate
- eMedicine
- Medscape/WebMD
- Micromedex
- ePocrates
- Paper resources (book, journal, etc.)
- Search Engine - Google
- Search Engine - Yahoo
- Search Engine - Other
- Other electronic resources

Save Answers
## CURRENCY: How do you rate the overall CURRENCY of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UpToDate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eMedicine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micromedex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ePocrates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper resources (book, journal, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Google</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Yahoo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other electronic resources</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## THOROUGHNESS: How do you rate the overall THOROUGHNESS of information of each of the following resources?

<table>
<thead>
<tr>
<th>Resource</th>
<th>Not</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDLINE (through Ovid, PubMed, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UpToDate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>eMedicine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medscape/WebMD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Micromedex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ePocrates</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper resources (book, journal, etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Google</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Yahoo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Search Engine - Other</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other electronic resources</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Appendix J

Physicians Comments from Questionnaire Comments Section

Note: Comments are presented as written, with typographical errors, etc.

1. a very interesting survey, sometimes we forget how much we use the internet (sic)
2. search can yield confusing and contradictory results, I tend to rely on the professional journal sites such as JAMA, NEJM, and sometimes aafp.org
3. good survey
4. as a resident I rely on electronic communication (email, twitter) with my peers to identify good resources
5. I use the pharma company sites quite a bit, even though I know they are biased
6. many of the drug companies have online (sic) resources
7. I still read journals monthly, but it is hard to keep up
8. you should do this over time and see how peoples usage (sic) changes
9. none
10. the PDR is still my most used resource
11. as a sole practitioner (sic) who does NOT see drug reps, I rely on the internet for much information, including research on current studies
12. I'm surprised you did not ask about the societies such as AAFP - academy of family physicians
13. how about the pharma company services - they offer access to their product information and some excellent disease state studies and data
14. none
15. our professional societies (sic) provide many resources as well for information and education
16. many of these sites are out of date and contradictory - I use IM and twitter to poll a trusted list of fellow physicians on some topics

17. realistically (sic) going on the internet for specific medical information is very time consuming and not always productive

18. was surprised at my own answers on how long it takes to complete a search

19. I am an active user of sermo, and find it is helpful for seeking guidance from my peers on information sources

20. well done survey

21. na

22. interesting survey, would like to see the result

23. just completing my residency - I am surprised that most of these sites require laborious access and inexact search methods. Kind of the difference between blackberry email and outlook (have to sign in etc).

24. another resource I am using is sermo - good way to get peer feedback on hot topics

25. thank you for askign (sic) me to participate - will be interesting to see results

26. surprised you did not ask about sermo - it is getting a lot of buzz, I tried it, too much work

27. paper is still a very valid choice- glad to see it in there

28. thank you for inviting me, it was very interesting

29. I work in a large hospital and it is often difficult to get online, but I do use these resoutrces (sic) - we are not allowed to see drug reps, so this is a good source of information

30. the survey was well designed

31. the online journals (JAMA etc) are a good source of information and linkages in addition to the paper versions

32. the search engines are not especially helpful because you get too much data and no sorting, and the drug companies pay to be at the top anyway

33. many of my associates use the drug company sites for information
34. even though they are of less importance now, I find professional gatherings are still an important source of information

35. I enjoyed this, would be interested to see how my answers compare to the other respondents

36. as the only woman FP/GP in a group practice (and the youngest) I am in the interesting position of sometimes helping my older male colleagues navigate the internet. Surprisingly, (sic) the older ones adapt most quickly since the younger ones have developed and ingrained search patterns based on other usage of the internet besides medical information (sic) search (sports, news?)

37. even though I have to filter the information, I find that wiki-md is actually quite helpful at times
Appendix K

Model for Information Literacy for Physicians

<table>
<thead>
<tr>
<th>Literacy concept</th>
<th>Content of Course</th>
<th>The physician will be able to do the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>How to vet a resource – Commonalties and differences</td>
<td>• Databases – scope, focus of information, and how to find ‘about’ information for each database</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• EMIP – scope, limitations</td>
<td>• Identify distinctive features in a database, know the scope and information it contains, and search and find relevant information</td>
</tr>
<tr>
<td></td>
<td>• Internet – brief history</td>
<td>• Identify distinctive features in an EMIP, know the scope and limitations of the information it contains, and search and find relevant information</td>
</tr>
<tr>
<td></td>
<td>• Web – definition, Web2.0 Web search engines – search algorithms, features (Google Scholar, Bing, Silobreaker, SearchMe, etc.)</td>
<td>• Compare databases and EMIPs to identify similarities and differences</td>
</tr>
<tr>
<td></td>
<td>• EBM resources</td>
<td>• Describe the basic features of the Web, search engines, and social networking functions (Web 2.0)</td>
</tr>
<tr>
<td></td>
<td>o What makes it EBM</td>
<td>• Define EBM resources as compared to researched or authored resources</td>
</tr>
<tr>
<td></td>
<td>o Meta-analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Textbook (electronic vs. paper) When one may be more helpful than another</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• EMIPS – How to assess – currency, quality of information, site sponsorship</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Who owns the resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o How often is the resource updated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Is it current?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>o Is it comprehensive?</td>
<td></td>
</tr>
<tr>
<td>Literacy concept</td>
<td>Content of Course</td>
<td>The physician will be able to do the following:</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------</td>
<td>-----------------------------------------------</td>
</tr>
</tbody>
</table>
| How to vet a resource (continued) | • How to judge EMIP expertise  
  o Review how your own specialty is covered  
  o Ask colleagues to review how their specialty is covered | • Understand the scope of paper resources vs. electronic resources, the ease of use of each, selection of each resource based on the information being sought  
 • Assess EMIPs, including those offered through pharmaceutical companies, libraries, and professional organizations |
| How to select the correct resource | • Type of question:  
  o Clinical questions  
  o Drug or medication questions  
  o Evidence-based medicine (EBM) reviews  
  o Continuing medical education (CME)  
  o Information to support your role as an instructor or medical school faculty  
  o Stay current in medicine  
  o Research (clinical trials, presentations, publication, etc.)  
  o Other questions  
  • Complexity of question  
  • Depth of information needed  
  • Time management - time frame in which information is needed | • Triage questions that appear in their profession by subject  
 • Identify the appropriate resource based on the information sought, complexity of the question, depth of information needed, and the speed with which the information is needed  
 • Exploit electronic resources available to support staying current within medical specialties (RSS feeds, electronic tables of contents, PubMed automated search, etc.) |
<table>
<thead>
<tr>
<th>Literacy concept</th>
<th>Content of Course</th>
<th>The physician will be able to do the following:</th>
</tr>
</thead>
</table>
| When to go to an information professional | • Time management -- assistance when searching for information  
  o Review information with information professional for accuracy and specificity  
  • Perform complex research across a series of resources  
  • Verify or enrich findings of searches already completed  
  • Assistance with updates to area of interest – training to enable RSS feeds, electronic tables of contents, PubMed automated search service, etc. Ongoing support from medical librarians  
  • copyright questions  
  • software licensing  
  • How to stay current in technology and information resources | • Partner effectively with information professionals  
  • Leverage the professional expertise of information professionals to save time and ensure the use of quality information in practice  
  • Effectively utilize medical libraries, information resources offered by hospitals or professional organizations, and other available technology support  
  • Take advantage of the resources and technology that support the life-long-learning available through medical libraries, websites, CME, guest speakers and professional organizations  
  • Comply with copyright restrictions regarding the use and sharing of text, images, and sound files |
<p>| Resources your patients may be using | • How to help patients understand whether or not their resources are reliable | • Distinguish between reliable and bogus information patients might find |</p>
<table>
<thead>
<tr>
<th>Literacy concept</th>
<th>Content of Course</th>
<th>The physician will be able to do the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources your patients may be using</td>
<td>• Resources for patient to get reliable information – what they offer</td>
<td>• Direct patients to reliable information resources and supporting organizations</td>
</tr>
<tr>
<td>(continued)</td>
<td>☐ Hospital medical library</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Public library</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Professional helping organizations, e.g., American Cancer Society, etc.</td>
<td>• Empower patients with additional information, allowing them to make informed decisions and understand their care plan</td>
</tr>
<tr>
<td></td>
<td>☐ MedlinePlus and other consumer sites</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Directories of helping organizations, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>☐ Resources in languages other than English</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>• Resources in the electronic medical record</td>
<td>• Effectively use information technology at the patient’s bedside</td>
</tr>
<tr>
<td></td>
<td>• privacy/security issues/ethics (HIPAA)</td>
<td>• Comply with privacy and ethical issues as they apply to medical information and HIPAA regulations</td>
</tr>
</tbody>
</table>
Reference List


