

Special Articles: Point-of-Care Medical Information

Use of On-line Evidence-based Resources at the Point of Care

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Background and Objectives: *The utility of on-line evidence-based summary databases for answering clinical questions at the point of care is not well understood. Our objectives were to determine if family physician faculty could answer their questions using on-line resources and the proportion of answers that influenced patient care.* **Methods:** *This was a prospective study in which clinical faculty in an urban residency training office recorded their clinical questions and their search results.* **Results:** *Faculty asked 92 questions. Therapy, prognosis, and epidemiology questions were the most common types of inquiries. Fifty-four percent of the questions were fully or partially answered by use of an on-line resource; obtaining an answer required 5–10 minutes of searching. Physicians reported that 62% of the obtained answers modified their opinion, influenced the care of the current patient 56% of the time, and would affect the care of future patients 70% of the time. Slow Internet connection and interruptions were the most frequent barriers reported.* **Discussion:** *Practicing physicians inexperienced in the use of on-line evidence-based resources answered a proportion of their clinical questions that was comparable to reports of more-experienced searchers; however, the time required to find answers limits the practical use of these databases during patient care time. On-line summary databases such as those used in this study show promise in providing answers that influence care during the patient's visit. With faster Internet connection (or handheld devices) and improved navigability, such resources have the potential to optimize health care in the primary care setting.*

(Fam Med 2003;35(4):251-6.)

Family physicians generate a substantial number of clinical questions while caring for their patients,¹⁻³ yet often leave their questions unanswered for lack of accessible, easy-to-find answers⁴ and difficulty managing the overwhelming quantity of medical information available.^{5,6} Fletcher et al⁷ identified standards of feasibility for methods by which busy clinicians might obtain information. First, the approach must be simple, rapid, concentrated, relevant, and accurate. Second, medical knowledge resources should contain frequently updated and peer-reviewed answers to specific clinical questions³ using the “best available evidence.”⁸

Currently, most practicing physicians rely primarily on colleagues^{1,2,9,10} and textbooks^{1,2} to answer patient-specific questions. At the other end of the spectrum are

the smaller number of evidence-based practitioners who are skilled at defining a problem, constructing and conducting an efficient search, critically appraising the evidence found, and considering the evidence in the context of their patients' circumstances.¹¹ However, only 5% of general practitioners think that “identifying and appraising the primary literature or systematic reviews” is a practical or appropriate way to obtain evidence-based information.¹² The emergence of electronic databases containing summaries of relevant research, called secondary literature,¹³ offer practicing physicians an alternative to searching the primary literature and/or finding invalid, outdated answers.

Although Internet-based on-line resources containing evidence-based medical information presented in summary format are available, the usefulness of such resources in the primary care setting is not well understood. If these resources can answer clinical questions at the point of care, where most questions occur,^{1,9,14}

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the quality of health care should be improved.^{13,15} However, few studies have examined the ability of primary care physicians to find information using on-line resources, and there is no information available on whether the application of evidence-based resources by practicing physicians actually improves patient care.

We conducted a study to explore the practicality and utility of training clinical faculty to use on-line resources for finding answers to clinical questions that arise in a family practice center. Specifically, we were interested in the proportion of clinical questions for which practicing physicians could find satisfactory answers using on-line resources and the proportion of those answers that reportedly modified clinical opinion and affected patient care. In addition, we estimated the median time primary care physicians spent searching for answers and the barriers encountered while using on-line resources to find those answers.

Methods

Setting and Participants

The study was conducted in an urban family practice center (FPC) that is an ambulatory clinical training site for Wayne State University (WSU) family practice residents in Detroit. Additional learners, such as medical assistant and physician assistant students, are also present in the FPC. Three to eight residents see patients in the FPC each half day. The site averages 1,200 patient visits per month.

Three board-certified family physicians with WSU clinical faculty appointments who practice and precept residents at the site participated in the study. These three faculty physicians each provide direct patient care 2 to 3.5 days per week and precept .5 to 1.5 days per week. The number of years in clinical practice in the United States ranged from 3 to 8 years, although one physician had many more years of practice in another country.

The participating clinical faculty physicians were relatively inexperienced in the use of computerized evidence-based resources to search for answers to clinical questions. Prior to the start of the study, the three physicians were asked how often they had used a computer to obtain medical information in the previous 3 months. The responses ranged from 1 to 20 times. The on-line resources most frequently used were medical information sites (eg, www.mdconsult.com and www.aafp.org) and on-line biomedical bibliographic information sites (eg, MEDLINE). None of the participating physicians reported using an evidence-based computer resource in the previous 3 months.

Computer Equipment and Connections

Computers with Internet connections were available to the physicians both in their private offices (minimum of Pentium MMX processors) and in common areas of the FPC, including the precepting station (minimum of Pentium II processors).

A large number of users (~50) in the FPC shared the dedicated 56 kbps frame relay. Therefore, data transfer was slowed substantially when the study physicians were accessing on-line information at the same time that other users were also downloading information.

Physician Training

Because of the physicians' relative inexperience in on-line searching, they were asked to attend two or three evidence-based, information-searching training sessions prior to the data collection phase of our study. We were concerned that without an introduction to the databases, the physicians would be less likely to use them. The following on-line evidence-based resources were used: InfoRetriever (www.infopoems.com/inforetriever.cfm), DynaMed (www.dynamicmedical.com), Translating Research Into Practice (TRIP) Database (www.tripdatabase.com), and Clinical Evidence (www.clinicalevidence.org). These resources were chosen because they are easily available, easily searchable, self-described as up-to-date, and using evidence-based principles for evaluating the validity of the information. Only InfoRetriever required a fee; the others were available free.

For each 1-hour training session, the physicians were asked to bring a clinical question for practice searching. One of the authors used those questions to demonstrate the possible search paths of the different databases. The physicians were given the opportunity to practice electronic searching using their own clinical questions; each physician searched for 15 minutes or less during one of the sessions. The sessions also provided the opportunity to discuss formulation of questions such that the possibility of finding an answer was optimized, as well as the data collection procedures. Additionally, a research assistant was available for help during searches. On two occasions, the research assistant guided a physician performing searches for approximately 1 hour.

Data Collection

During the 3-month data collection period (mid-April 2001 to mid-July 2001), the three physicians generated clinical questions, searched for answers using their choice(s) of electronic databases, and completed a data collection form for each of their search experiences. The three physicians were instructed to record all clinically related questions (ie, their own clinical questions or questions from residents or staff) as they arose during patient care, excluding questions about medication dosage, formulation, and side effects; questions regarding insurance matters; and items that were retrievable from the patient medical record. No other restrictions about the nature of the clinical questions were imposed. The physicians were given the option to access on-line resources during patient care hours (including

precepting), during non-patient care hours (eg, lunch-time or administrative time), or at home after work. For each question, a data collection form was completed, which documented their on-line searching experience (regardless of their success in finding an answer) for that question.

The data collection form captured the following items: the question, source of the question (attending physician, resident, student, or staff); when the question was generated (direct patient care, precepting session, or other); which computer resources were searched; which of those resources provided a complete or partial answer; and amount of time spent searching for an answer on-line. Physicians also recorded if the information modified their clinical opinion, if it influenced the care of the presenting patient, and if it would affect the care of future patients. If they used a resource in addition to one of the five designated on-line resources, the alternate resource search was documented in the same manner.

Data Analysis

Clinical questions were categorized (ie, therapy, prognosis, epidemiology, diagnosis, prevention/screening, and general information) by consensus of three of the authors after the study was completed. Descriptions of clinical question categories from Sackett et al's *Evidence-based Medicine: How to Practice and Teach EBM*⁸ were used to guide category selection.

The level of data obtained from questions on the data collection form was either nominal or ordinal. Therefore, proportions and medians were used to summarize responses regarding search experiences and impact on patient care. Chi-square testing was used to determine differences in proportions.

Results

Questions

Ninety-two questions were recorded by the three physicians over the 3-month study period. The study physicians were the source of most of the questions (68%); another 24% originated from interacting with residents during precepting sessions (Table 1). Students and nonphysician staff working with the physician prompted the remainder of the questions.

Therapy questions were the most common category of question (50%), followed by prognosis questions (14%). Table 2 includes example questions representative of each category. As Table 1 shows, the majority (82%) of questions were generated and pursued dur-

ing the course of patient care; 48% were generated while the physicians were seeing their own patients and 34% while they were precepting.

Search Time

There was a greater proportion of searches lasting less than 10 minutes during patient care hours than during non-patient care sessions ($P=.001$). Individual search sessions were longer for questions related to prevention/screening (10–15 minutes), compared to all other question categories (5–10 minutes). When we compared the proportion of answers found with searches under and over 10 minutes in length, we found no statistically significant difference.

Databases Used

The TRIP Database was the most commonly used (81 searches), followed by InfoRetriever (35 searches). The physician who initially conducted the most searches had more success with TRIP than with the other databases and may have influenced the other two physicians to also use TRIP. The physicians used additional resources to search for 27 questions. Medical textbooks (eg, *Clinical Evidence*,¹⁶ *Harrison's Principles of Internal Medicine*,¹⁷ and *Essentials of Family Medicine*¹⁸) were the most common additional resources used. One physician initiated several searches using the search engine Google (www.google.com).

Of the 92 questions posed, the three physicians found answers using an evidence-based computer resource for

Table 1

Characteristics of Questions Asked and Answered

	Questions Asked	Questions Answered	
<i>Source of Question</i>			
Faculty	62 (68%)	31 (50%)	
Resident	24 (26%)	16 (67%)	
Student	3 (3%)	1 (33%)	
Nonphysician staff	3 (3%)	2 (67%)	
<i>Category of Question</i>			<i>Median Search Time (Minutes)</i>
Therapy	46 (50%)	30 (65%)	5–10
Prognosis	13 (14%)	5 (38%)	5–10
Epidemiology	12 (13%)	6 (50%)	5–10
Prevention/screening	10 (11%)	6 (60%)	10–15
Diagnosis	8 (9%)	3 (38%)	5–10
General information	3 (3%)	0 (0%)	5–10
<i>Context of Question</i>			
Direct patient care	44 (48%)	22 (50%)	5–10
Precepting session	31 (34%)	21 (68%)	10–15
Non-patient care hours	17 (18%)	7 (41%)	10–15
Overall	92 asked	50 answered	5–10

Table 2

Sample Questions by Category

<i>Question Category</i>	<i>Sample Question</i>
Therapy	<ul style="list-style-type: none"> • Are antidepressants used to treat seasonal affective disorder? • Is surgery effective treatment for stress urinary incontinence?
Prognosis	<ul style="list-style-type: none"> • Is the risk of miscarriage less with CVS or amniocentesis? • Does breast-feeding (versus not breast-feeding) help women lose weight postpartum?
Epidemiology	<ul style="list-style-type: none"> • What is the incidence of chronic hepatitis in patients with tattoos? • What is the incidence of pulmonary embolism in the absence of DVT?
Prevention/screening	<ul style="list-style-type: none"> • Is yearly TB testing necessary for health care professionals? • What is the benefit of doing Papsmear for patients after hysterectomy?
Diagnosis	<ul style="list-style-type: none"> • What ACE level is diagnostic for sarcoidosis? • How often does ear tugging correlate with ear infection?
General information	<ul style="list-style-type: none"> • Can STDs be treated in minors without parental consent?

CVS—chorionic villi sampling

DVT—deep venous thrombosis

TB—tuberculosis

ACE—angiotensin-converting enzyme

STD—sexually transmitted disease

50 (54%) questions (Table 3). The physicians reported that 62% of those 50 answers modified their opinions and influenced their patient care: 56% of the answers influenced patient care provided that same day, and 70% (35/50) of the answers would affect the treatment of future patients.

Resources other than the four on-line databases provided answers for 15 of 27 questions (56%). Of those 15 answers, 40% reportedly modified the opinion of the searching physician, and 47% (n=7) influenced patient care provided that same day.

Barriers

The most frequently reported barriers to using the on-line resources included slow Internet connections, inadequate information, and difficulty interpreting information. Additionally, the physicians reported interruptions during

18% of searches, which may have prevented them from finding answers to their question.

Discussion

This faculty development project represents one of the first studies to determine the potential usefulness of on-line evidence-based resources in answering clinical questions at the point of care by practicing family physicians. Our clinicians were able to find answers to 54% of their 92 questions using the on-line resources included in the study. This proportion is similar to that reported for more-experienced evidence-based information searchers. For example, Alper et al¹⁹ reported that experienced computer searchers answered 75% of 20 questions generated from family physicians using a combination of electronic databases. Chambliss et al³ collected unanswered questions from a convenience sample of family physicians. Fifty-four percent of the questions were answered completely or nearly completely by medical librarians using MEDLINE. Gorman et al¹⁴ collected clinical questions from 49 nonacademic primary care physicians during 1 half day of patient care. Experienced medical librarians searched MEDLINE for answers to these questions. The physicians reviewed these answers compiled by the librarians and reported that a “clear answer” was provided for 46% of their questions.

Our practicing physicians found answers to most clinical questions after 5 to 10 minutes of searching, which is substantially longer than the 2 minutes or less that physicians typically spend seeking answers to questions.² Questions related to prevention and screening took longer to answer than questions in other categories, and spending more time searching did not improve the proportion of answers found. The slow Internet connection at our FPC was a problem frequently encountered by the physicians, resulting in time-consuming searches. It is unlikely that busy physicians would be able to routinely devote this amount of time to finding answers to their clinical questions while seeing patients.

Table 3

Physician Report of Search Outcome and Utility of Answers

<i>Resource</i>	<i>Answer Found</i>	<i>Answer Modified Physician Opinion</i>	<i>Answer Influenced Current Patient Care</i>	<i>Answer Will Affect Future Patient Care</i>
On-line resource	50/92 (54%)	31/50 (62%)	28/50 (56%)	35/50 (70%)
Other resource	15/27 (56%)	6/15 (40%)	7/15 (47%)	7/15 (47%)

We also were interested in determining whether the information obtained was valued by the physician and influenced patient care. The study physicians reported that 62% of the answers modified their opinion and that 56% of the answers changed their approach to the current patient. In addition, they anticipated that 70% of the answers would affect the care of future patients. By comparison, the physicians studied by Gorman et al¹⁴ estimated that the answers provided by medical librarians would have influenced the care of the presenting patient in only 40% of cases and affected the physician's practice only 51% of the time.

Limitations

Several features of this study may limit its generalizability to other clinical situations. First, only a handful of evidence-based resources were used, and the greater use of one of the databases over the others may have been influenced by the initial success with this resource of one physician searcher. However, the purpose of the study was not a systematic comparison of different electronic databases. Rather, we sought to determine the general utility of on-line resources during patient care.

Second, only three physicians participated in the study; all are part of an academic practice where computer-searching skills may be encouraged more than in nonacademic settings. Yet, the experience level of the participating physicians was more similar to nonacademic physicians than physician researchers.

Third, although the training sessions may have improved the physicians' comfort level with the computer tools, it is unlikely that the physicians gained significant searching experience at the sessions. Fourth, physicians' offices with access to a high-speed Internet connection will experience faster searches and will likely have a greater probability of finding an answer in a limited amount of time. However, the computer hardware and Internet connectivity at the study site may be similar to the resources in many physicians' offices.

Another concern about the generalizability of our results is that the number of questions generated by the three physicians is lower than the number generated by physicians in previous reports. This may have occurred for several reasons. First, determining the rate of clinical questions was not a goal of the study; rather, we were interested in estimating the utility of these tools in a setting that was as "real world" as possible. Therefore, physicians were not observed or solicited for their questions as was done in other studies.^{1,3,14} Second, we excluded questions that were related to medication dosage and side effects, which are often the most common type of clinical question received in other studies.²⁰ Finally, it is possible that when physicians were busy, they did not record their questions at the time they arose and then forgot them. We do not know how many ques-

tions were missed and whether the answers to those questions would have been found using the on-line resources or if they would have influenced patient care.

Conclusions

Literature on the effectiveness of interventions to change the behavior of professionals indicates that passive interventions are usually ineffective in changing physicians' behavior.²¹ Using computers and the Internet to search for answers to clinical questions is an active process and may have more potential to change behavior and encourage physicians to become evidence users.¹¹ Databases such as those in this study show promise in providing answers that influence patient care during patient care. With faster Internet connection (or handheld devices) and improved navigability, such databases have much potential to optimize health care in the primary care setting. Currently, however, searches take longer than most busy clinicians would be willing to spend, and these searches answer only about half their questions. The excessive time required for finding information, as well as difficulties related to question formation and search strategies, were recently documented in a study of Iowa primary care doctors.²² Until quicker, more-complete tools are available, physicians are unlikely to rely on electronic databases to improve patient care during patient care.

Acknowledgments: We are grateful to Linda Roth, PhD, and Diane Moorman, PhD, who, through the Champions Project, provided faculty development expertise.

Funding for this study was through DHHS Health Resources and Services Administration grants D32-PE-10239 and D45-PE-50088.

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