Knowledge Resource Preferences of Family Physicians

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Because of the pivotal role of medical knowledge in clinical problem solving, it is important to understand how clinicians decide to seek additional knowledge for patient care decisions and how they choose among the resources available to them. Using a self-administered questionnaire, 126 family physicians reported their use of 11 types of knowledge resources for answering patient-specific questions arising in clinical practice. They reported almost daily use of the Physicians' Desk Reference *and more often than weekly use of colleagues. There was little use reported of* Index Medicus *or computer-based bibliographic retrieval systems. The research literature of medicine was used infrequently and rated among the lowest of resources in terms of credibility, availability, searchability, understandability, and applicability. In deciding among a subset of knowledge resources for answering a clinical practice question, resource cost variables related to clinical availability and applicability of the information to the problem at hand appeared to be more influential in the minds of physicians than factors related to quality of the resource. These findings have important implications for the development and deployment of knowledge resources intended to be useful and used in clinical practice.* **J Fam Pract 1990; 30:353-359**

Investigators of the clinical problem-solving process have repeatedly shown the strong problem-specific performance of clinical problem solvers.[1–4] Knowledge, not problem-solving strategy, is what differentiates expert from nonexpert performance.[5] Medical educators have recognized the challenge posed by the magnitude, continued growth, and evolution of medical knowledge.[6,7] During their preclinical education, students cannot assimilate all of the scientific knowledge that they will need in practice. Much of what is learned will be outmoded by new scientific knowledge before their training is completed. By promoting the development of skills for continuous and independent learning, medical educators will be preparing students for the essential role of the physician as a lifelong learner. Such learners must have authoritative knowledge resources linked to the practice environment.[8] Yet, because physicians regard the knowledge resources available to them for answering patient management questions as inadequate, many such questions go unasked and unanswered.[9] Once in practice, keeping current with the rapidly expanding base of medical knowledge is a formidable task in which physicians have not been entirely successful.[10–13]

Some suggest that new technology such as bibliographic retrieval systems, hypertext software, and electronic encyclopedic resources will meet the growing need for accessible practice knowledge. The experience of others[14,15] belies this view, however. Although physicians claim heavy reliance on the literature to answer practice questions, observational studies have contradicted this claim.[9] Clearly more information is required about what knowledge is needed to support the care of individual patients, what factors contribute to knowledge seeking and the choice of resources, and how knowledge can best be delivered to the practice setting. A better understanding is needed of how physicians balance the potential benefits of seeking knowledge with the temporal, cognitive, and monetary costs associated with this search.

In this study family physicians report the use, value,

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and costs they ascribe to contemporary knowledge resources available in clinical practice. Those factors appearing to be most important in influencing the choice among knowledge resources are identified.

ASPECTS OF KNOWLEDGE RESOURCE SELECTION

This investigation examines the information-seeking behavior of family physicians in community practice. The principal motivation for information seeking in this study is patient-care decision making, not education, research, or administration. Information-seeking behavior is defined as any activity undertaken to obtain information that satisfies a perceived need.[16] Furthermore, the behaviors of interest are activities intended to satisfy immediate specific needs (ie, information-seeking behavior) rather than those activities in which information is accepted and stored to be recalled later if and when a need arises (ie, information gathering). This latter activity is often defined as "keeping up with the literature." In clinical practice the object of information seeking could be patient-specific data, knowledge from the domain of medicine, meta-knowledge specifying an approach to problem solving, or recommendations arising from inferences that integrate patient data and medical knowledge. In this study the information object is medical knowledge useful for the care of the individual patient.

A utility-cost model was used to represent the process by which a physician decides whether and where to seek additional knowledge. The model is adapted from a strategy selection model, described by Beach and Mitchell[17] and Christensen-Szalanski,[18] which is conceived as a special instance of a more general selection process. The decision whether and where to seek knowledge is represented as a compromise between the conflicting goals of a need for information that reduces uncertainty, and a resistance to time, effort, or monetary expenditures. If the use of all knowledge resources is perceived to be more costly than is warranted by the value of the information expected from them, no additional knowledge will be sought. If more than one knowledge resource is perceived as having greater value than cost, the source that is perceived as having the greatest net value will be pursued.

Within the model, several general characteristics of knowledge resources have been described that are of importance in the present context. These characteristics include resource quality factors such as knowledge *extensiveness* or *scope* (ie, the breadth of information contained within a resource) and *credibility* (ie, how likely is the resource a repository of correct, believable information).[19] In addition, there are accessibility issues that give rise to expenditures.[20] These include *physical accessibility* or *availability* (ie, how close is the resource to the site of clinical practice), *functional accessibility* or *searchability* (ie, how easy is it to find the needed knowledge in the resource once it is at hand), and *intellectual accessibility* or *understandability* (ie, how easy is it to read and understand the information). A fourth general cost characteristic is *clinical applicability* (ie, the ease with which the knowledge obtained from the resource can be applied in the clinical setting). These accessibility and applicability factors give rise to the expenditure of physical or mental energy and involve an allocation of personal time. While the use of knowledge resources could involve a direct monetary cost, that factor is not a central concern of this study. Assuming these features of knowledge resource selection are valid, there is little research relevant to how the clinician assigns relative weights to the quality and cost factors of the various media. From the research literature of librarianship the general finding is that convenience (the minimization of accessibility and applicability costs) outweighs quality characteristics when selecting an information source.[21]

METHODS

A questionnaire was mailed to 311 physicians listed on the clinical faculty roster of the Department of Family Practice and Community Health at the University of Minnesota. The clinical faculty are distributed throughout the state of Minnesota. A cover letter briefly described the underlying purpose of the study and requested the cooperation of the recipient in completing the questionnaire. The questionnaire was a slightly modified version of one developed and tested with a group of internists in an earlier study.[22] The nine-page questionnaire was composed of three parts: a demographic page, the main body of knowledge resource questions, and a final page regarding local computer and telecommunication resources, which was part of another study. The demographic page asked the respondents to specify their specialty and subspecialty, their years in practice, size of community, type of practice, and size of practice group. In the main body of the questionnaire, the physicians were asked to rate 11 different knowledge resources pertinent to clinical practice, including human, printed, and electronic forms. The order of the resources was randomized once, and this order was used for each resource characteristic question. The resources and a corresponding prompting example were listed for each question as follows: general medicine textbooks (eg, Harrison's *Principles of Internal Medicine*); computerized bibliographic retrieval (eg, MEDLINE, BRS Colleague); colleagues in your specialty

TABLE 1. TEXT OF QUESTIONS USED IN QUESTIONNAIRE

1. Please indicate how frequently you use the different resources listed below in solving problems that arise in your clinical practice.

2. How *extensive* is the amount of medical knowledge contained within each of these resources?

3. How great is your *confidence* in the *correctness of information* for each of these sources?

The final items in this survey relate to four issues in using general medical information resources (such as textbooks) for answering questions in the course of medical practice. First, in order to use any resource, it must be *readily available* in your clinical practice. Second, it must be reasonably *easy to find the needed information* within each resource. Third, the information you find must be clearly presented or *easy to understand.* Finally, the information you find must be reasonably *easy to apply* to the clinical problem you are trying to solve. We wish to learn your opinions regarding these issues for several different types of information resource that you must use in your clinical practice.

4. How *readily available* is each of these resource for helping you in your clinical practice?

5. How *easy* is it *to find needed information* within each resource?

6. How *easy to understand* (ie, clearly presented) is the information that you find in each of these resources?

7. How *easy to apply* in your clinical practice is the information that you obtain from each of these resources?

or subspecialty; medical subspecialty textbooks (eg, *Gastrointestinal Disease* by Sleisenger and Fordtran); *Index Medicus*; colleagues in other specialties or subspecialties; original research (journals); clinical manuals (eg, *Washington University Manual of Medical Therapeutics*, *Current Therapy*); review articles (journals); *Physician's Desk Reference* (*PDR*); and pharmaceutical industry representatives.

For each knowledge resource, physicians were asked to estimate their frequency of use on a 5-point Likert scale. The scale points were less than once a month, monthly, weekly, daily and several times a day. Next, respondents were asked to indicate on 5-point scales their ratings of the six resource characteristics described above relevant to the knowledge-selection process (Table 1). The end-point labels of each scale were the characteristic modified by "not" at one end and "very" at the other (eg, not available and very available). Following the questions on use, extensiveness, and credibility, a brief paragraph introduced the terms regarding availability, searchability, understandability, and applicability and their sequencing. All of this information was placed in the context of answering patient-specific questions that arise in the course of medical practice. The survey documents and return envelopes assured anonymity. No follow-up reminder mailing was sent.

Information from the questionnaires was entered into a microcomputer database. Data editing was required of a small number of questionnaires in which the respondents had circled two contiguous Likert scale responses in a few instances. In these cases the less extreme of the two circled values was entered into the database (ie, if 1 and 2 were circled, 2 was entered, if 4 and 5 were circled, 4 was entered). Differences in ratings among the resources was determined using Tukey's method for comparisons of multiple means. The relative importance of resource characteristics in predicting resource use was determined using multiple linear regression and analysis of variance.

RESULTS

One hundred sixty-two physicians completed questionnaires and one retiree returned an unanswered questionnaire (52% response rate). Family medicine was the most frequently listed specialty (126, or 78% of respondents) followed by internal medicine with 10, general surgery with 6, and pediatrics with 4. The questionnaires from the 126 physicians listing their specialty as family practice were used for subsequent analysis.

Physician Characteristics

Of the 126 responding family physicians, 73 (58%) lived in cities with a population greater than 150,000 while 28 (22%) lived in towns of less than 10,000. Of the 120 family physicians in group practice (95%), 67 were in single-specialty practice, 46 in a multispecialty group, and 7 were in a hospital-based group. For those in group practice, the size of the group was between 2 and 10 for 55% of the family physicians, between 10 and 20 for another 23%, and greater than 100 for 11%. Four family physicians were in solo practice and two were primarily involved in administration. The length of time in practice ranged from 2 to 41 years, with a mean of 15 and a median of 12 years.

Frequency of Use

The means of the self-reported frequency of use and assessments of resource characteristics for the 11 knowledge resources are summarized in Figure 1. The respondents reported that they used the ubiquitous *PDR* slightly more often than daily, and used colleagues, both with the same specialty and with another specialty, more frequently than weekly to obtain information to answer clin-

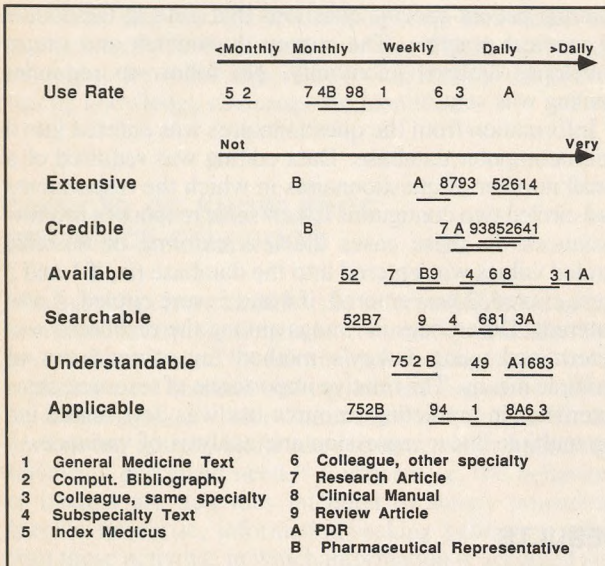

Figure 1. Mean use, quality, and cost ratings by 126 family physicians. Lines connect resources that do not differ at $\alpha = 0.01$ using Tukey's multiple comparison test.

ical questions. They reported little use of *Index Medicus* or computerized bibliographic retrieval systems. The remaining resources were all used at about the same frequency rate ranging from monthly to somewhat less than weekly.

Resource Quality Ratings

For the resource quality characteristics of extensiveness and credibility, there was not much differentiation made by respondents other than for pharmaceutical industry representatives, which were rated low. Subspecialty and general medical texts, other specialty colleagues, and literature-indexing systems (resources 4, 1, 6, 2, and 5) were rated somewhat higher than other resources in both extensiveness and credibility.

Resource Cost Ratings

For the four remaining characteristics, clinical availability, searchability, understandability, and clinical applicability, the literature indexes, research articles, and pharmaceutical industry representatives (resources 5, 2, 7, and B) were consistently rated low. Most available and searchable were the *PDR*, general medicine texts, and same-specialty colleagues (resources A, 1, and 3). Same-specialty colleagues were rated as most understandable, followed closely by clinical manuals, other-specialty colleagues, general medicine texts, and the *PDR*. Same-specialty and other-specialty colleagues were rated as providers of the most clinically applicable information, followed by the *PDR* and clinical manuals (resources 3, 6, A, and 8). There was little correlation between quality and cost characteristics but significant correlation between the two quality characteristics and among the four cost characteristics. The quality characteristics of extensiveness and credibility ($r = .68$) and the cost characteristics associated with searchability and applicability ($r = .68$) were the most highly correlated pairs.

Resource Use Correlates

Those in multispecialty practice reported less knowledge resource use than those in a single-specialty practice ($P < .05$). In addition, the time in one's specialty was inversely correlated with self-reported use ($P < .05$). None of the other demographic variables correlated to reported resource use rates.

With the single exception of extensiveness, all of the resource characteristics were significantly correlated with the frequency of resource use ($P < .001$). To identify which resource characteristics and demographic variables independently explained the frequency of use ratings, multiple regression analysis was performed. Frequency of use was best explained by clinical accessibility and applicability as follows:

(1)

$$\text{Use} = 0.220 + 0.344 * \text{Availability} + 0.293 * \text{Applicability}$$

$$(R^2 = .334)$$

Thus, both availability and applicability significantly predicted increased knowledge resource use. None of the other resource or demographic characteristics added a significant effect beyond clinical availability and applicability.

Equation 1 indicates that 33.4% of the variation of knowledge resource use is accounted for by the predictor variables as chosen. To examine for the presence of additional influential characteristics that are specific to a resource, each of the 11 resources was added to the model as a dummy variable. The resultant regression equation had an associated $R^2 = .518$. The improvement in multiple correlation coefficients indicated that there was variation in knowledge resource use that was associated with characteristics of the individual resources independent of the model's quality and cost indicators. This additional variation was hypothesized to be related to type of resource. Using multiple regression, a four-way grouping of resource types was found adequate to specify these differences. The resultant resource groupings were as follows: (1) colleagues (same and other specialty), (2) index (*Index*

Medicus and computerized bibliographic retrieval systems), (3) *PDR*, and (4) other (medical textbooks, clinical manuals, research and review articles, and pharmaceutical industry representatives).

(2)

$$\text{Use} = 1.231 + .183 * \text{Availability} + 0.121 * \text{Applicability} + 0.907 * \text{Colleague} - 0.801 * \text{Index} + 1.425 * PDR \quad (R^2 = .533)$$

The resulting model of knowledge resource use using grouped resources lost no explanatory power over the model with each resource entered singly. By taking additional resource group characteristics into consideration, the explanatory power of the regression equation (R^2) was considerably improved over equation 1.

Comparison to Internal Medicine Faculty

The self-reported use of the family physicians was compared with a group of 27 faculty internists in a teaching hospital. Similar patterns were noted between the two groups with the exception of the internal medicine faculty making more use of research articles and *Index Medicus* and less frequent use of clinical manuals. The *PDR* and pharmaceutical industry representatives did not appear in the questionnaire administered to the internists.

DISCUSSION

The existing breadth and the ongoing rapid expansion of medical knowledge require access to and use of clinical knowledge resources. The self-reported use of knowledge resources described here (daily use of the *PDR* and almost alternate daily use of colleagues) is much greater than the self-reported weekly needs of internists in the office practice environment reported by Covell et al.[9] In that study, the observed potential need was much greater (approximately 12 instances per day) than the self-reported use need (weekly). While the validity of both observed potential and self-reported information needs may be questioned on methodologic grounds, both probably underestimate the actual knowledge need in clinical practice, as both encompass only situations in which need is explicitly recognized by the physician. This discrepancy between potential and perceived need may be indicative of a high rate of implicitly choosing not to obtain information because its contribution is judged not to be worth the time and effort entailed in seeking to find it. This study is meant to shed light on how this judgment is made. For instance, the discrepancy may be partially explained by the finding that resource cost factors are much more heavily weighed into the decision to use a system than are quality factors. Many clinical questions judged to have minor importance can be expected to go unasked unless the physician perceives a knowledge resource to be readily at hand that is likely to quickly provide a clear-cut, easily applied answer.

Family physicians in multispecialty group practice reported less frequent knowledge-seeking behavior than those in single-specialty practice. Covell et al[9] found that, in the office practice setting, 69% of a subspecialist's knowledge questions dealt with problems outside the subspecialist's field. In a multispecialty group practice setting, patients can be triaged and referred to the appropriate specialist. Thus, any particular physician may experience less need for information that falls outside of his or her specialty.

The *PDR* was determined to be the most frequently used as well as most readily available knowledge resource. Williamson et al[10] found that physicians put drug information at or near the top of patient care information needs. Clinicians rapidly gain familiarity with the topic structure of the ubiquitous *PDR*, using it to answer a narrow set of common but important clinical questions about medications. Respondents gave the *PDR* high marks for the key factor of clinical applicability as well as searchability and understandability.

Next to the *PDR*, clinicians tend to prefer to use colleagues for knowledge resources. While colleagues were not rated quite as available as the *PDR* in most practice situations, their advice was rated more clinically applicable. The interaction with colleagues allows for clarification and questioning so that applicability can be maximized. Hard-to-understand information can be repeated and restated in a way specifically targeted to the recipient's level of understanding. The consulting physician's ready identification with the inquiring physician's role and concern as a care provider causes the insightful consultant to appropriately tailor the answer so that it is concise and sufficiently complete, with explanations and process information, to allow the requesting physician to implement any suggestion with an appropriate level of confidence.

Respondents indicated little use of computer-based index systems for answering clinical practice questions. *Index Medicus* and computer-based indexes received poor marks for availability and were perceived as providing information not directly applicable to clinical practice. Judgments about quality and costs of these resources may be somewhat uninformed. Fifteen percent to 18% of questions regarding indexing systems went unanswered by the respondents. Increasing familiarity is known to influence positively the perception of accessibility of a resource.[23] Increased exposure would improve the reported accessibility of such systems. New software carefully tailored in

terms of the human interface could make computerized bibliographic retrieval systems much easier to use.

Making bibliographic indexing resources more conveniently available and usable, however, will not necessarily make them used. Limited clinical applicability is a characteristic of what they identify, the literature of medicine. Clinicians rated research articles lowest of all resources in terms of clinical applicability and understandability. Research articles were second only to pharmaceutical industry representatives in terms of low credibility, a not altogether unwarranted view.[24] The low ratings of research journals by practicing physicians have been noted by others as well. Greer[25] found a "universal skepticism" of practicing physicians regarding the usefulness of scientific literature. Practicing physicians view the literature primarily as a vehicle for researchers to communicate to other researchers, and find the practical content of research articles wanting. Stross and Harlan[26] pointed out the lack of prominence of clinically useful information in the literature. Colleague-to-colleague communication is a far more important and compelling means of influencing local trends in health care. Thus, even if indexing systems were conveniently placed and provided easy direct access to the entire article, the poor clinical applicability, understandability, and credibility of the target information are likely to limit their use for answering patient-specific questions.

Computerized bibliographic retrieval systems with better search strategies, coupled with innovative ways of presenting and consolidating research results to make them more understandable and applicable, could possibly change the equation. This improvement might be accomplished through the development of "validated reviews"[10] that could be made accessible through bibliographic retrieval systems. The respondents, however, rated review articles rather modestly on all characteristics. Unless special attention is paid to make validated reviews clinically applicable, use rates may be disappointing even if they become readily available. Huth[27] has succinctly expressed the challenge as developing new systems to provide clinicians "expertly selected, carefully assessed, thoroughly digested and highly relevant information drawn from current literature" delivered in a way that is "rapidly accessible when the need arises, precisely and accurately responsive to the specific questions and cheap in terms of time and other costs."

The large additional explanatory contribution of the dummy variables exhibited by equation 2 indicates that knowledge resources present factors in addition to the ones explicitly studied here that influence their use as information resources. For example, working with colleagues provides the opportunity to seek reassurance and encouragement, foster referrals, share responsibility, socialize, and break routine. While monetary cost perceptions were not explored in the questionnaire, these can be especially significant for computerized bibliographic retrieval systems. A number of related characteristics of the knowledge seeker are likely to have an important influence on the use of some resource types. Familiarity with a resource has been shown to be an influential factor,[28] the rating of which would be expected to be quite high for the *PDR* and very low for indexing systems. Computerized bibliographic retrieval systems appear especially unapproachable to some physicians because of perceived difficulty in learning and maintaining proficiency in their use.[15] Finally, there is at least one important task variable that would be expected to affect knowledge resource use estimates but not be directly accounted for by the study model's focus on resource characteristics. That variable is the relative frequency of topic focus of the questions that arise in clinical practice. Resources focused on frequently questioned topics have a higher likelihood of being considered for use, independent of quality or accessibility considerations, than resources that offer less coverage of such issues. For instance, perhaps the reported high priority need for drug information[10] accounts, at least in part, for the physicians reporting daily use of the *PDR*.

Factors of resource cost related to accessibility and applicability appear to be much more influential in the decision to use a resource than are characteristics of the resource's knowledge quality. This finding was also reported in other studies of physicians[28] as well as other professionals.[21,23,29] The most commonly cited reason for use of knowledge resources for practicing dentists was convenience, with reliability and comprehensiveness trailing.[30] Accessibility and applicability factors also appear to be much more differentiated by practitioners.

Many similarities in knowledge resource use were noted between family physicians and a group of internal medicine faculty in a teaching hospital.[22] The faculty internists reported use of same specialty colleagues and other specialty colleagues about as often as did the family physicians. Indexing systems were used somewhat more often, but still infrequently, even though such resources were readily available in the teaching hospital library. The only significant difference in use rates was that the internal medicine faculty used research articles and *Index Medicus* more frequently and clinical manuals less frequently. This difference may be explained on the basis that the more academic setting of the internists encouraged familiarity with the research literature, and the presence of house staff buffered the faculty from the need for clinical manuals. The internal medicine house staff did, in fact, report a significantly higher rate of clinical manual use than did the family physicians. Just as the family physicians, the internists did not widely differentiate among the resource quality indicators, and they consistently rated

indexing systems and research articles to be low on accessibility and applicability.[22]

The most obvious limitation of this study is that it is based on self-reported use rather than observation, and thus is subject to biases of memory and interpretation. In addition, with a 52% response rate, the sample of clinicians could be nonrepresentative. Furthermore, the study did not include some resource, knowledge seeker, and task characteristics likely to be influential in determining use. Among these are monetary costs, perceived difficulty in learning and maintaining proficiency with a resource, familiarity with a resource, and the relative frequency of clinical question topics. High correlations indicate that physicians may find it difficult to separate the various quality characteristics or the various cost characteristics of knowledge resource classes. Despite these weaknesses, consistency of response patterns regarding knowledge resource preferences between the family physicians and internists and good correlation with other reported studies[9] suggest that these findings are valid and somewhat generalizable. The strong reliance on colleagues reported here is similar to that found in similar studies involving a survey of dentists[30] and observation of cardiovascular care nurses.[31]

For those developing new knowledge resources, the resource must be close to the clinical action if use is to be fostered. Furthermore, efforts spent on improving accessibility and applicability are much more likely to have an impact than efforts directed at improving the quality of a resource. The content of the knowledge resource must be clinically relevant and presented in a clear manner that is easily applied to the clinical task. The ability of colleagues to understand the clinical situation and question of interest, to tailor their response to the level of understanding of the questioner, and to present an answer that is easy to apply to the clinical situation sets a high standard for knowledge system developers.

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