THE DISSEMINATION OF CLINCIAL PRACTICE GUIDELINES OVER AN INTRANET: AN EVALUATION

by

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TABLE OF CONTENTS

Figures and Tables

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Abstract

This study traces the evolution of the Kaiser Permanente Northwest electronic clinical practice guideline dissemination system. It was hypothesized that placing guidelines on an intranet would make this information easier to retrieve. Retrieval time, retrieval accuracy, and ease of use were empirically evaluated. Sixteen clinicians from Kaiser Permanente volunteered to complete tasks which measured these variables. Time values were significantly longer for tasks completed with intranet guidelines (Intranet=6.7 minutes, Paper=5.7 minutes). Tasks completed with paper guidelines had a significantly higher percentage of perfect scores than those completed with the intranet (Paper=85%, Intranet=59%). The was no significant difference in reported ease of use. Simply placing clinical information on an electronic system does not guarantee that the information will be easier to retrieve. Such information needs to be fully integrated into the clinical decision making process. Computerizing guidelines may provide a necessary initial step toward this goal, but it does not represent the final solution.

Introduction

Over the past several years, the Internet has become a ubiquitous part of computing. While early Internet applications focused on electronic communication in the government and academic sectors, the introduction of the World Wide Web (WWW) has increased general interest in the technology. The growing popularity of the Internet has not only introduced the world to a new way of sharing information globally, it has also sparked changes in internal corporate communication. An intranet is an internal computer network based on the same technology as the WWW. Many businesses (Carr, 1996; Sprout, 1995; Weston, 1996) have recently begun to use intranets as a convenient and cost-effective way to distribute internal information to their employees. This technology has been adapted in health care information systems (IS) and, as a result, intranets are also surfacing in various health care organizations. In the following study, two methods of clinical practice guideline implementation are compared. It is hypothesized that guidelines provided on an intranet will allow more efficient and accurate retrieval of relevant information than guidelines provided on paper.

The present study focuses on Kaiser Permanente Northwest, which has used its intranet to make clinical practice guidelines, as well as other information, available to its clinicians (Mullich, 1996). While most early applications of intranet technology have focused on general corporate information, such as the company phone book and its general policies, Kaiser is providing information

that may have a direct impact on the practice of its clinicians. If these users see the intranet as a useful tool to access guidelines, then we can recommend that the intranet may be a practical interface for other elements of the computer-based patient record (CPR), or at least that further integration of intranet guidelines into the CPR is warranted. Columbia-Presbyterian Medical Center (New York, NY) has investigated the viability of a Web-based clinical information system, though investigators acknowledged that additional evidence would be required before such a system could be accepted (Cimino et al., 1995).

To date, little has been done to evaluate an intranet as a viable means of delivering clinical information to clinicians. This study traces the evolution of this system and performed an experiment with clinician users to examine the capability of Kaiser's intranet to serve as a guideline dissemination tool. These users will also be surveyed to elicit a subjective evaluation of the current system and to generate topics for future research in this area.

It is hypothesized that placing guidelines on an intranet will make this information easier to retrieve. Retrieval time, retrieval accuracy, and ease of use will be empirically evaluated. In addition to these dependent variables, it is anticipated that subjective participant responses will elucidate the advantages of the intranet system. By studying these factors, the author hopes to critically evaluate the current efficacy of the Kaiser intranet dissemination system and make recommendations as to how this system, and others like it, can be improved in the future.

Clinician information needs and information-seeking behavior

In the process of making a clinical decision, a clinician must choose from various sources of information, including his or her previous memory-based clinical knowledge and the medical history of the patient in question. Periodically, the clinician will choose to seek additional knowledge in order to make an appropriate decision. In an average patient encounter, clinicians choose from various sources of information to make diagnoses and prescribe necessary medications or procedures. In a recent article, Elson et al. (1997), described health care from an "industrial process" point of view, and the authors set out to recommend the implementation of industrial quality improvement methods in the health care setting. According to this view, the primary production process is clinical decision making and the fundamental "products" are clinical decisions. The following study approaches the decision making process from Elson et al.'s perspective as this view lends itself to a consideration of the various constituent parts that comprise the clinical decision process as a whole.

Numerous studies have focused on the information needs and information-seeking behavior of clinicians. As time passes, medical science generates massive amounts of new data regarding the management of health and diseases (Hersh, 1996a). Keeping up with current research has largely been left as the responsibility of the clinician, but with the exponential rise of information comes the realization that no physician can be expected to remember every pertinent fact relating to his or her practice. Outside sources of information exist

to provide clinicians with new medical knowledge and decision support. Some studies have suggested that important factors in determining where physicians seek information are perceived "resource cost" variables, such as the availability of a resource and the applicability of that information to current questions (Connelly, 1990; Curley, 1990). These data suggest that the quality of outside sources may not be the most important factor used to determine their usefulness and the authors have highlighted the need for clinical information systems developers to ensure that decision support tools are conveniently located near the person making the decision. In addition, one author called for research that asks physicians to rate more narrowly defined resource categories, such as the current study prescribes (Curley, 1990).

Other studies have chosen to analyze the questions that arise during the decision making process and how clinicians choose which clinical questions to answer. Osheroff et al. (1991) studied information needs among attending physicians, house staff, and medical students in a general medicine training program. The investigators recognized that many information needs required a synthesis of both medical knowledge and patient data, and as such were potentially difficult to satisfy. Since this study was carried out in a clinical teaching environment, the high number of questions observed may not be representative of normal daily practice, but the authors also offered a typology of information needs, categorizing them as either "consciously recognized," unrecognized," or "currently satisfied." The authors note that since computers

have increased the quantity of information that can be accessed rapidly, computer-based decision support tools may be helpful in locating answers to clinical questions.

Having recognized that many clinical questions arise over the normal course of patient care, and that clinicians do not always seek answers to these questions, investigators have also explored how physicians choose which questions to answer. In their research, Gorman and Helfand (1995) studied factors that motivate primary care physicians to seek answers to some of their clinical questions, while leaving others unanswered. They suggest that the "cost factors," previously deemed important in information seeking, may not be sufficient to describe a tendency not to seek new information. Other factors are important, including the urgency of the patient's problem and the expectation that a definitive answer exists.

In general these studies have acknowledged an information deficit among clinicians and have highlighted various factors that lead clinicians to seek the assistance of external resources when answering clinical questions. The rapidly expanding knowledge base in medicine coupled with the time pressures facing today's clinicians can be detrimental to the clinical decision making process. As reported by Ely et al. (1995), physicians cite "lack of knowledge" as one characteristic that can potentially lead to critical errors during patient care. In an effort to continually improve clinician access to the most currently accepted medical knowledge, various groups have begun to develop new clinical

information resources and new methods of distributing this information.

Clinical guidelines

While there are many different types of clinical information sources, this study focuses on clinical practice guidelines. These guidelines are intended to be a distillation of collective thinking from medical literature, academic experts, practicing physicians, and health care organizations on how to treat a particular medical situation (Bergman, 1994). One of the important advantages of guidelines lies in the relief they offer clinicians from having to read every article that relates to the latest advances in modern medicine. Guidelines may address numerous aspects of clinical care, including prevention, screening, diagnosis, or the treatment of disease. Regardless of the content, Wilson et al. (1995) suggest that to be clinically important, a guideline should convince its user that the benefits of following the recommendations are worth the expected harms or costs.

As with any change in the delivery of health care, the introduction of clinical guidelines has been met with some trepidation. Guidelines seek to capture the best evidence available, and summarize it such that recommendations can be made regarding treatment of the average patient presenting with a specific medical condition. The problem is, of course, that every patient is an individual, and part of a clinician's task is to identify the subtle nuances that can affect a diagnosis. The subtle aspects of clinical

judgment cannot always be measured empirically with quantitative evaluations, for example (Woolf, 1995). Thus, guidelines should be evaluated by examining the evidence for and against their efficacy and clinicians should be notified as to the extent of confidence in published guidelines. Woolf cautions against overstating the certainty of guideline recommendations and underestimating the complexity of patient care with rigid, simplistic decision rules. Thus, while guidelines may prove to be an important clinical resource, clinicians must ultimately rely upon their own clinical judgement (Eagle, 1996). Educating clinicians to treat guidelines in this manner should quell any arguments that they promote "cookbook medicine."

While clinical guidelines have only recently become widely used in the health care industry, their effectiveness has been investigated. In an extensive review of the literature, Grimshaw and Russell (1993) examined the impact of guideline use. The authors found that 55 of 59 studies reported significant improvements in the process of care after the introduction of clinical guidelines. While the investigators concluded that explicit guidelines can improve clinical practice, they also noted that the size of improvements was variable. In one example, the authors describe a study by Hopkins which evaluated guidelines for the management of hypotensive shock in a U.S. emergency room. Hopkins found that care complied with guidelines in 82% of patients treated by residents, compared to 45% treated by a control group. Of patients in the intervention group, only 14% required ventilation compared with 33% treated by the control

group. In contrast, a study by Sanazaro reported only a 2% increase in compliance with treatment guidelines and failed to detect any change in outcome following the dissemination of guidelines.

Among the factors that appeared to impede guideline use were the methods of development, dissemination, and implementation. For example, in one of the studies reviewed, investigators compared the increase in compliance between guidelines that had been developed by physicians within the clinic in question and those derived by external sources. Investigators reported a 32% increase in compliance when family physicians from the clinic were involved with guideline development. In contrast, only a 22% increase in compliance was observed when the guidelines had been developed by others. These data may suggest that the source of guideline development has a direct effect upon clinician buy-in. Appropriate contextual decisions must be made at each of the points listed above if guidelines are to make an impact in a specific clinical environment (Grimshaw, 1993).

In general, Grimshaw and Russell have identified potential shortcomings in the three critical areas of guideline origin that may lead to a low, or below average probability of guideline use and effectiveness. On the development side, they state that when the guideline source is external to the organization, compliance will be less than when development has an internal component. With regard to dissemination, mailing to targeted groups and journal publication have proven less effective than specific educational intervention or continuing

education programs. Finally, with respect to implementation, providing general feedback and reminders has been less successful than providing patient-specific reminders at the time of consultation or patient-specific feedback.

Woolf (1993) explains that more sophisticated approaches for disseminating clinical guidelines are needed. On the development end, the author calls for an emphasis on local guideline development within health care organizations. This step has been recommended by medical sociologists who argue that such involvement increases the buy-in of that organization's clinicians (Greer, 1988). In addition, Woolf (1993) recommends the input of patients, who can provide valuable insight into the perspective of the consumer and greater sensitivity to patient preferences.

A study by Ellrodt et al. (1995) supports the development of new clinical guideline implementation strategies. Factors affecting physician compliance with guidelines were investigated. In their conclusion, the investigators note that attempts to improve guideline performance need to address more than physician buy-in, and must also address implementation. Woolf (1993) notes that publishing guidelines in medical journals and utilizing mass mailing distribution, such as that previously employed by the Agency for Health Care Policy and Research (AHCPR), have not proven to be effective methods. In a recent report, Jones et al. (1997) set forth a recommendation template for the development and dissemination of clinical guidelines. The authors note that computerizing guideline documents in a format for clinical use is an integral step

in the development process.

Guidelines are currently implemented in a variety of ways, even within a single organization. For example, while clinicians at Kaiser Permanente Northwest receive their guidelines in an indexed binder with paper inserts, they can also access this information on the Kaiser corporate intranet.

Computer-based clinical decision support

Discussion up to this point has highlighted the complexities of the clinical decision-making process. Clinicians must analyze the data presented by each patient within the context of that individual's similarity and/or deviation from previous cases. The clinician relies not only on his or her own knowledge base, but also on the myriad sources that seek to provide summaries of the latest clinical knowledge. As discussed earlier, external knowledge sources are proliferating exponentially. Clinical guidelines offer one strategy for managing this vast set of clinical information, presenting it to clinicians as a means to save time, encourage consistency, and provide a reliable source of current experimental knowledge. However, as with any clinical information source, the method of dissemination plays a role in determining the extent of its use. The use of computers to manage clinical information has received much attention for its potential to aid in the efficient distribution of clinically relevant information.

Computerized decision-support tools can be divided into the categories of "active" and "passive." Whereas active sources seek to incorporate specific

patient data into a computerized process to reach a conclusion, passive support tools make information needed for decision making more readily available, but do not otherwise process the information (Elson, 1995b). Elson et al. (1995) explain that a major problem with diagnostic decision support systems for primary care is that the underlying knowledge bases often have limited relevance to primary care settings. Computerized access to resources such as the MEDLINE database, a passive information tool, has been successful for the academic medical community, but has offered little help to clinicians trying to make decisions at the point of care.

Guidelines were introduced to filter the medical literature for a consensus of the most current accepted practice and to provide clinicians with relevant clinical information. However, the problem of clinician access may still prevent widespread use of this resource. Computerizing guidelines may prove to be a successful mode of dissemination. Within the realm of computer-based support, the advent of the Internet and its related technologies has provided systems developers with promising new tools with which to disseminate clinical information.

The World Wide Web and the emergence of intranets

With the introduction of the WWW, information of any kind could be shared globally in a visually appealing manner with relative ease. The physical network and information transmission protocols necessary for such

communication were already being utilized by the government and academic communities. Thus, with the advent of the "Web browser," anyone with a computer could easily navigate through page after page of multi-media information with the click of a mouse. A browser is simply a software program that runs on an individual's computer that sends commands over a phone-line, or equivalent connection, to another computer (usually a dedicated machine, or "server," that acts as a repository for "Web pages"). These browsers have proven easy to use in that they rely on a relatively intuitive visual format, a graphical user interface (GUI). For example, if a user wanted to visit a previous page, he or she would simply click on a virtual "button" that reads "BACK."

Entering a uniform resource locator (URL) on a Web-browser will send a signal from that computer over the network to a server holding the page that corresponds to that unique address. The server responds by returning the summoned page to the original computer, which has its own unique address. Thus, a Web page is simply a document that is housed on a remote server that one can retrieve, displaying the information on one's computer monitor. These documents may display many types of information. For example, a corporate Web-site likely houses pages that display not only textual information about the company's latest products, but also color images of them, and possibly a movie depicting their latest T.V. commercial. In addition to this basic information, the company may also provide "links" to other related Web sites. Using the mouse to click on one of these links brings a new page of related information to the

user's computer. With the expansion of the Web's popularity has come a rapid increase in the amount of information available there. Unfortunately, this has resulted in a tool that has been of limited use to clinicians seeking reliable medical advice on the treatment of specific diseases. Currently, content on the Web is highly distributed, difficult to find, and clinical information is not separate from non-clinical information (Hersh et al., 1996b).

While there are many advantages to using the WWW as a means to distribute information, with the vast amount of information available, the question becomes, can a person find what he or she needs? More recently, businesses have been deploying the components used to navigate the Web within their corporate walls. By separating themselves from the Internet as a whole, and setting up internal servers to store relevant corporate information, businesses can essentially create their own internal Web, minus the irrelevant information of the WWW. These internal networks, called "intranets," are increasingly used in the corporate sector.

Intranet use has increased rapidly for a variety of reasons. As many businesses already provide employees with Internet access, the jump to a corporate intranet is a small one (Bickel, 1996). Since browser software is relatively platform-independent, meaning the type of desktop computer being used rarely matters, the business can avoid the need to replace existing hardware when implementing such a system. In addition, the software requires little training. Posting information on the server can be accomplished with relative

ease using Hyper Text Mark-up Language, or HTML, which is the current programming language of choice for the Internet/intranet. Document changes need only be made once, to the original HTML file, or to a database consisting of the intranet's content. Thus, the technology ensures that employees always have the most up to date information at their fingertips. This saves a corporation from having to distribute thousands of paper copies of a document, then thousands more when a change is made. Besides such administrative advantages, dynamic information, such as complex images and movies can be disseminated using this format. That same content would be difficult or impossible to distribute on paper.

Security of such a system is often called into question by skeptics. Using software (e.g. password protection) or hardware boundaries (e.g. dedicated internal connections), the corporation can control access to sensitive internal information, and keep their internal network free from traffic that might otherwise impede document retrieval times. This barrier, in whatever form it manifests itself, is known as a "firewall."

Disseminating guidelines on the Kaiser Permanente intranet

The benefits listed above have led to interest in applying the principles of the Web to clinically related information. For example, a group at Oregon Health Sciences University has developed a Web-based system which serves as an index to clinical content at the level of the health care student or clinician

(Hersh et al., 1996b). Their system eliminates the need for users to sift through low-quality and/or unrelated material to find reliable clinical information. Numerous groups have developed WWW servers to support clinical decision support and education.

Among those using Web technology to distribute clinically relevant information are health care organizations like Kaiser Permanente Northwest, which had nearly 4000 users on its intranet at the end of 1996. Kaiser Permanente (KP) is America's largest not-for-profit health maintenance organization, serving 9.1 million members in 19 states and the District of Columbia. An integrated health care delivery system, KP organizes and provides or coordinates member's care, including preventive care such as well-baby and pre-natal care, immunizations, and screening diagnostics; hospital and medical services; and pharmacy services. KP serves members in California, Colorado, Connecticut, Georgia, Hawaii, Idaho, Kansas, Maryland, Massachusetts, Missouri, New York, North Carolina, Ohio, Oregon, South Carolina, Texas, Vermont, Virginia, and Washington. This study focuses on Kaiser Permanente Northwest. Today, more than 414,000 residents in the Northwest are members of Kaiser Permanente. More than 560 physicians, representing 40 specialties, work exclusively for the organization. It operates 19 medical offices in the Portland and Salem areas of Oregon, and in the Vancouver and Longview areas of Washington.

Kaiser is utilizing its intranet to, among other things, provide clinicians

access to on-line clinical practice guidelines. By supplying this information on the intranet, "the physician who wants to look at 'back pain' [for example] can get a summary of guidelines on how to diagnose the condition, plus patient education material," (Booker, 1996). On the surface, dissemination of clinical practice guidelines via a corporate intranet appears to be an ideal use of this technology and may have an important influence on clinical practice. By uniformly providing the most current version of these guidelines in an easily accessible format, Kaiser's information technology managers believe clinicians may be able to make better medical decisions regarding patient management.

A gradual evolution has taken place in dealing with the information needs of clinicians, and attempting to provide high quality clinical care in the most efficient and cost-effective manner. Clinical guidelines were introduced to address the problem of keeping up with rapidly changing medical practice methods. These guidelines may alleviate some of the pressure on clinicians to read every practice-related article that crosses their desks. In addition, guidelines promote consistency across clinician practices and often suggest cost alternatives when treatment is necessary. Once an organization has found an acceptable method of guideline development, however, the issue of dissemination arises. The quality of information may not be enough to entice physicians to consult the information source. The material must be presented such that it is a logical extension of the natural decision-making process.

The current research compares two methods of guideline distribution.

The purpose is to evaluate an intranet as a means of distributing clinical information, comparing it to a paper-based system of guideline dissemination. Following from Elson's (1997) description of clinical decision-making, this examination focuses on the "information-seeking" portion of that process. The variables in question are 1) source-specific retrieval accuracy, 2) source-specific retrieval time, and 3) subjective measures of various decision-maker satisfaction and behavior issues. It is hypothesized that scores indicating efficiency, accuracy, and ease of use will be improved by placing guidelines on an intranet.

This study adds important data to an otherwise sparsely examined area. It is a first step toward exploring the efficacy of an intranet as a source of clinical decision-support, and toward generating new questions for future research in this area.

Methods

Study Design

An experiment was performed to compare two methods of clinical practice guideline implementation. Four experimental "tasks" were developed relating to the information contained in the guidelines. Each task required subjects to locate specific pieces of clinically relevant information. Each participant completed two tasks with a binder of paper guidelines and two additional tasks using the intranet version.

The aim of the experiment was to determine whether there were differences in the efficiency and effectiveness of the two methods of guideline dissemination. It was hypothesized that "task completion time" would be faster for tasks that were completed with the intranet version of the guidelines. Task completion was limited to ten minutes. Participants were aware that they had ten minutes to complete each task, but were not informed that their task completion time was being measured. Questions not finished within ten minutes were scored "incorrect." Thus, the second hypothesis was that tasks completed with the intranet would have higher scores, on average, than those completed with paper guidelines. The null hypotheses for the experiment are that there are no differences in the efficiency or efficacy of the different methods of guideline dissemination.

In addition to doing the two tasks, each participant completed a survey requesting demographic data, information on experience with clinical guidelines

and computer technology, and a subjective evaluation of the two dissemination methods. One measure from this survey, namely "ease of use" was analyzed along with task completion time and task score.

Experimental Setting

The current investigation evaluated the two methods of clinical practice guideline distribution utilized by Kaiser Permanente Northwest. The study was completed at various Kaiser clinics in the Portland, Oregon and Vancouver, Washington metropolitan areas. Experimental sessions were completed in the offices of participating Kaiser clinicians. The only setting requirement was that subjects had access to the Kaiser intranet in their offices. The duration of the experimental sessions ranged from approximately 35 minutes to one hour. The study was designed such that all experimental tasks could be performed in one hour or less.

Subject population and selection of subjects

The study population for this experiment was Kaiser Permanente Northwest's internal medicine and family practice clinicians, including physicians, nurse practitioners, and physician assistants. This group includes approximately 250 clinicians. An e-mail announcement was distributed to this population, explaining that Kaiser was completing a study of its clinical guidelines and that volunteers were needed. Potential subjects who lacked

experience with the Kaiser intranet were excluded from the study by stipulating in the announcement that intranet experience was a requirement for participation. While a definition of "intranet" was not included in the message, it was assumed that those who were unfamiliar with the concept would exclude themselves from the experiment. Thus, clinicians from either of the two specialties who had at least limited experience with the Kaiser intranet system were eligible for inclusion in the study. A total of 16 clinicians eventually participated in the experiment. All volunteers were accepted. There were no volunteers who did not meet the requirements stipulated in the study announcement. However, it is acknowledged that the method of recruitment may have introduced bias into the experiment. Using an e-mail announcement automatically excluded those clinicians who may not read their e-mail. However, it is estimated that this group represents a very small minority within Kaiser. There may also have been bias introduced by using only clinicians who were familiar with the intranet. Again, this subgroup is estimated to be small within the organization. A detailed demographic description of these subject is located in the results section of this report.

Measurement Tools

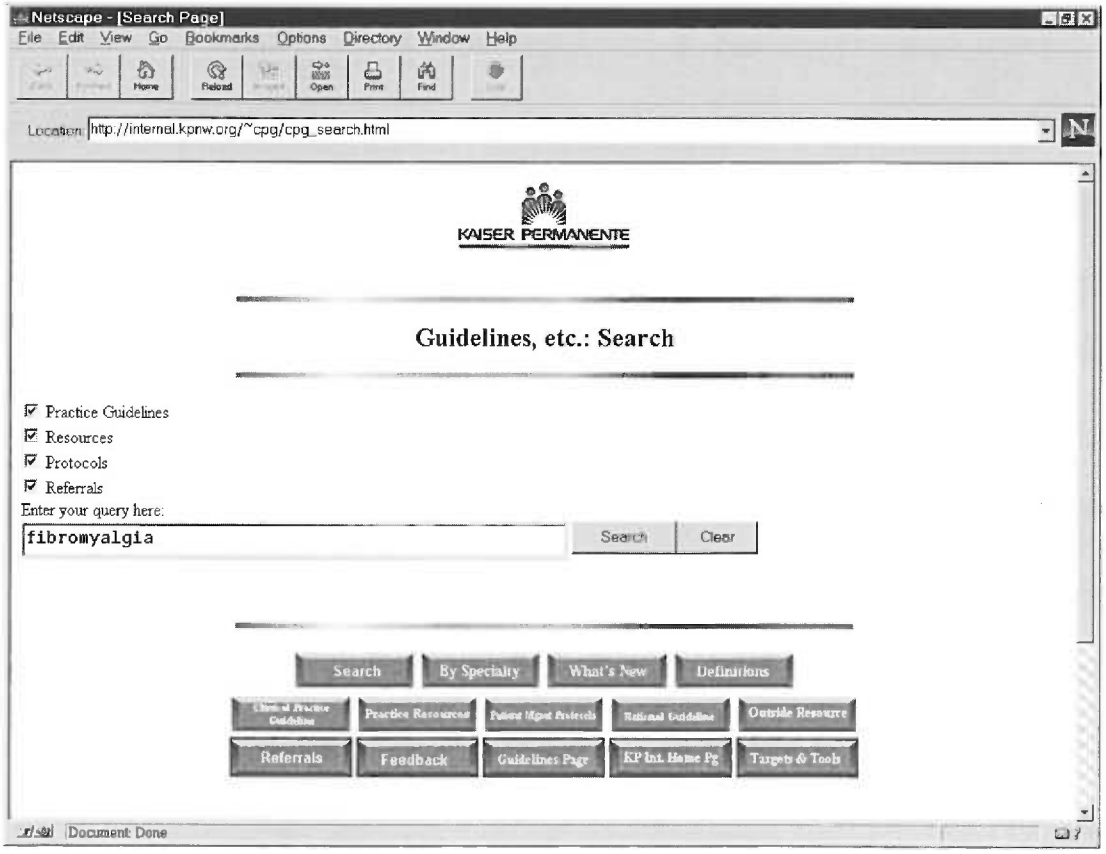
Kaiser Permanente Northwest currently uses two methods to disseminate clinical practice guidelines: 1) an indexed binder, containing photocopies of Kaiser's clinical practice guidelines and 2) the Kaiser intranet, which provides a

Web-based interface to the guidelines in electronic form. In addition to the inherent differences between reading and accessing documents on paper, as compared to accessing them electronically, these tools also differ in their general organization. The binder is divided by tabs indicating the gross category within which each guideline falls. For example, the guideline "Congestive Heart Failure," can be located by opening the binder tab labeled "Cardiovascular." Intranet users are able to access guidelines in an electronic format. Selecting "Guidelines, Etc." from the main Medical/Dental Resources page (Figure 1), presents clinicians with Kaiser's main guidelines page. The guidelines page provides multiple guideline searching methods (Figure 2). First, the user can

Figure 1. Kaiser Permanente's Main Medical/Dental Resources Intranet Page

enter a word or phrase into the home page search engine. A search engine is a Web interface that takes a word or phrase as input, and returns one or more links to related information that is located either on the WWW, or in the case of this experiment, within the Kaiser intranet. Search engines are typically commercially distributed, and may vary in implementation from vendor to vendor. Kaiser Northwest uses a search system designed by Verity© (Sunnyvale, CA). This tool enables administrators to organize, build and centrally maintain a collection of indices for documents stored on their intranet servers. Using this system, Kaiser enables users to construct rich queries or to select queries from corporate query libraries. For example, if a clinician were to enter the term "fibromalgia" into the search engine on the guidelines main page

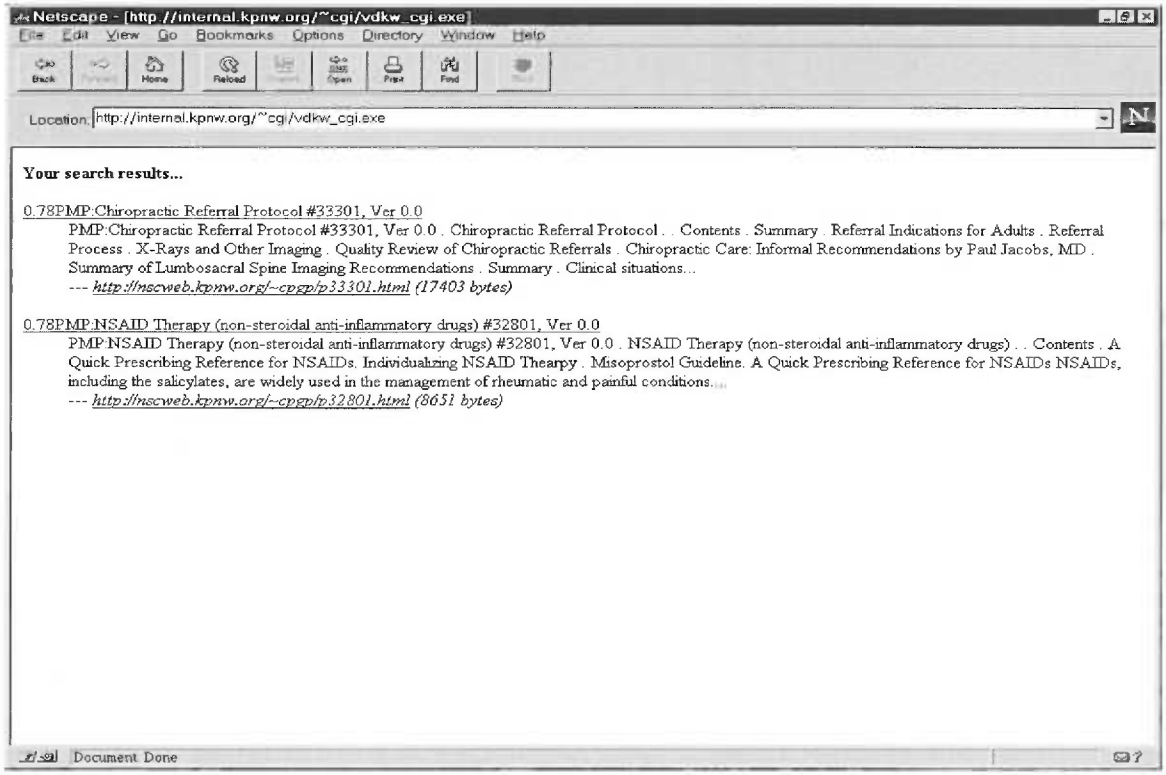
Figure 2. Kaiser Permanente's Main Guidelines Search Page



(Figure 2), then a result set containing links to the guidelines with information on fibromalgia are returned (Figure 3). As an alternative to the search engine, guideline links can be viewed as an alphabetical list or by specialty when the user uses a mouse to select from images on the guidelines main page that resemble "buttons" (Figure 2). For example, if the "SPECIALTY" button is pressed, guideline links are presented by specialty. Subsequent selections may be made until the desired guideline is displayed.

Four guidelines were selected from a Kaiser Permanente Northwest's collection of clinical practice guidelines for study in the current investigation. The guidelines were subjectively determined to be of equivalent density and complexity of information provided, and were all of similar length. Two of the

Figure 3. Sample Result Set from Kaiser Permanente Search Engine



the paper guidelines (Congestive Heart Failure, Headache in Primary Care) are actually printouts of the intranet version. Therefore, the content of these guidelines is exactly the same in both versions. Differences exist only in the way the guidelines are accessed and in the fact that the links provided in the intranet version are of no use in the paper version. The content of the remaining two guidelines (Treatment of Acid-Peptic Disorders, Acute Low Back Pain) is also exactly the same, but they differ slightly in presentation. For example, differences exist in the font used, the overall structure of the guideline (i.e. the order of presentation), and the absence of links in the paper version. Thus, despite subtle differences, the overall content of all four guidelines is similar in scope and design, but different in subject matter.

A task was designed to correspond with each of the guidelines listed above by developing questions that could be answered using the guideline (Appendix A). Each of the four tasks tests how efficiently specific clinical information can be gleaned from an appropriate clinical practice guideline. Both versions of each guideline were examined to ensure that the appropriate information was available to users. The four tasks were reviewed by two physicians who judged the questions to be both clinically relevant and consistent with the language used by clinicians. Each task contains a brief introductory paragraph that points the user to the appropriate guideline. The five questions found in each task can be answered using this guideline. A Kaiser physician who is familiar with the clinical practice guideline system and the Kaiser intranet

participated in a "pre-test" of the tools to ensure that the allotted time for each task would be approximately sufficient for task completion.

Each subject completed Task A, Task B, Task C, Task D, and the survey (see Appendices A and B). Thus, the experiment generated 16 values of TIME and SCORE for each of the four tasks. Eight of the TIME/SCORE values for each task were generated by subjects using the paper version of the guidelines and the other eight values were generated by subjects using the intranet guideline versions. In addition to completing the four tasks, participants were surveyed both verbally and by questionnaire (see Appendix B).

Selection of Variables

The format of guidelines used to complete the experimental tasks serves as the independent variable in this study. The two formats studied were "paper," corresponding to the binder of paper guidelines, and "intranet," corresponding to the electronic version of the guidelines. Three dependent variables were analyzed to measure the consequence of changes on the independent variable. First, the completion of each task yielded a score corresponding to the correctness of responses (i.e. did the answer match, or closely resemble a pre-determined "correct" answer). The second variable was time, corresponding to the time each subject needed to complete each task. Finally, subjects rated each format for subjective ease of use. Henceforth, when these terms are used as variables, they will be capitalized. These variables were

derived from a list of potential areas of study, suggested by Elson et al. (1997). In their article, the authors list source-specific and/or data-specific seek times and retrieval accuracy as two of the most important candidate process variables related to information seeking.

Subjects were also asked questions regarding demographic data, their subjective experience level with related information technology, and their subjective impression of the current guideline dissemination tools (see Appendix B for questionnaire). Besides Visual Analog Scale (VAS) and yes/no questions, open-ended questions were designed to gain overall impressions of guideline use and dissemination. Answers to these questions and any comments and/or suggestions from participants were recorded in a journal and will be presented as anecdotal evidence.

Data Analysis and Statistical Methods

Tasks were designed such that each question had a pre-determined correct answer. Each task was assigned a SCORE, according to the number of correct responses. Blank questions were scored as incorrect. In addition, a TIME value was recorded for each task that could theoretically range from zero to ten minutes. The post-task questionnaire was measured and response rates were tabulated. Descriptive statistics, including mean and standard deviation were obtained for all data. The majority of demographic responses and subjective measures were not analyzed for statistical significance due to the small sample

size.

The three variables that underwent detailed statistical analysis were TIME, SCORE, and EASE OF USE (henceforth referred to as EASE). SCORE was dichotomized into the relative percentages of 1) perfect task scores and 2) those tasks in which at least one question was incorrect. In order to take advantage of the small number of available clinicians, a randomized block experimental design was employed. Rather than have each clinician perform only one assessment, each participant assessed a unique combination of task and format. For example, the tables below (Figure 4) illustrate a hypothetical task ordering for two subjects. While both subjects received the tasks in the same order, Subject 1 completed the first two tasks using the intranet version of the guidelines, while Subject 2 used the paper version to complete these same tasks. The various combinations were randomly assigned to subjects that took part in the experiment. This design allowed multiple assessments on one experimental unit (in this case, a clinician), whereas a traditional equivalent design which assessed one task and one format per clinician would have required 64 participants.

A randomized block ANOVA was performed for TIME, SCORE, and EASE, to determine whether differences across TASK, FORMAT, or an interaction between TASK and FORMAT, were statistically significant. Each of the dependent variables was partitioned out during the analyses. While the data for the three variables in question did not pass tests for normality, their relative

Figure 4. Experimental Task Ordering

Subject 1

INTRANET		PAPER	
TASK A	TASK B	TASK C	TASK D

Subject 2

PAPER		INTRANET	
TASK A	TASK B	TASK C	TASK D

skewness allowed the analyses to be accepted. R-Square values and F scores are reported for each of the dependent variables, indicating what percentage of variation was explained by each test, and what the significance levels were.

Descriptive measures were performed using JMP software. Statistical analyses were performed using SAS data analysis software (SAS Institute, Inc., 1994).

Human Subjects

This study was granted an exemption by the Human Subjects Committee of the Institutional Review Board at Oregon Health Sciences University. This satisfied the review requirements of Kaiser Permanente.

Results

A total of sixteen subjects volunteered to participate in this study.

Demographics and Subjective Responses

The gender breakdown of participants was 7 females and 9 males. Of the 16 subjects, 13 were MD's 2 were Nurse Practitioners (NPs) and 1 was a Physician Assistant (P.A.). Eleven of the clinicians categorized themselves as internal medicine (IM) practitioners while five reported being family practitioners (FP).

The average age of participants, as well as several other demographic and subjective results are listed in Table 1. Participants were asked to report the number of years that they had been practicing medicine ("Years in clinical practice"), and the number of years spent in the Kaiser organization ("Years practicing at Kaiser Permanente"). The results in Table 1 illustrate that there was a fairly wide spread of both experience and time spent with Kaiser.

Participants were asked to rate their computer experience level using a standard Visual Analog Scale (VAS), from 0 to 100 (0 corresponded with "Novice" and 100 corresponded with "Expert") (Table 1- "Computer experience"). In addition, subjects were asked to rate their familiarity (on a scale from 1 to 10) with the Internet (WWW)/Kaiser intranet as an information tool (Table 1- "Familiarity with WWW and/or Kaiser intranet"). Both of these scores clustered about the midpoint of the scale. This would appear to indicate that participants had both average levels of computer experience and familiarity with

the intranet. While participants may have been average compared to their Kaiser peers, it is likely that

Table 1. Demographic and subjective response data

	MEAN	STANDARD DEVIATION (SD)
Age	42.4	6.9
Years in clinical practice	11	7.4
Years practicing at Kaiser Permanente	8	6.4
Computer experience	55 (out of 100)	19.4
Familiarity with WWW and/or Kaiser intranet	4.8 (out of 10)	1.8
EASE- paper	42.8 (out of 100)	17.1
EASE- intranet	46.6 (out of 100)	15.0

their actual experience levels would be higher, when compared to the population at-large considering the amount of exposure that Kaiser clinicians have to computer tools during their daily practice.

Three additional subjective questions were asked of all participants regarding their experience with the guideline tasks and format during the experiment. First, subjects were asked the question, "When using the intranet version of your clinical practice guidelines, did you use any of the available search –aids (for example: the FIND feature, the search-engine, or any of the internal hypertext links)?" Nine of the 16 subjects responded "NO" to this question, while the remaining 7 answered "YES."

Second, subjects were asked whether they would prefer a "'short' guideline, consisting of an algorithm and its essential notation, or a 'long' guideline, containing a full textual description of the subject matter in question." Participants were instructed to circle one of the following: SHORT, LONG, or DEPENDS, and were asked to explain their answers if DEPENDS was chosen. Five subjects specified a preference for short guidelines, two preferred long guidelines, and nine participants explained that their choice would depend on circumstances. For example, one subject explained that it would be preferable to use "short" guidelines that would enable the user to "drill down," or follow links within the document that would allow users to dynamically decide how much detail they needed. Another subject explained the it would be preferable to have both short guidelines to use as a "quick reference" and long guidelines, when more detail was desired or needed. Finally, one subject commented that it would depend upon how much time he or she had. While it is often preferable to have more information, the participant explained that time constraints usually preclude one from sifting through volumes of information to find a specific answer.

Finally, subjects were asked whether the intranet, as it currently exists, was "robust enough" to replace the paper version of the guidelines. Eleven subjects responded "YES" and the remaining five answered "No" to this question.

Dependent Variables

Analysis of variance (ANOVA) is used to test hypotheses about differences between two or more means. It can be used to test differences among several means for significance without increasing the Type I error rate (i.e. that a true null hypothesis is incorrectly rejected). If there is significance reported for an ANOVA, it implies that the means in question differ more than would be expected by chance alone. If the effects are not significant, then the differences between the means are not great enough to allow the conclusion that they are different. Where a significant result is reported in this experiment, the interpretation of mean scores has been included.

A randomized block ANOVA was performed to determine whether there were significant differences across task and format for TIME, SCORE, and EASE values. The a priori alpha value for these tests was .05, meaning that significance levels below .05 were interpreted as significant values.

The ANOVA for mean TIME values found significant differences across task and format (Paper: 5.7 minutes; Intranet: 6.7 minutes), but no significant difference for format by task. The R-Square value for this analysis was .71. This result implies that there was a significant difference in mean task completion time across the four tasks where tasks completed using the intranet took an average of one minute longer than those completed with the paper version (Table 2).

Of the 64 tasks completed, 18 had scores of less than 5. Of these 18 non-perfect scores, 13 were the result of subjects not completing the tasks in the allotted ten minute time period provided. Questions left blank were marked

Table 2. ANOVA for TIME across task and format

Factor	Pr>F
Task	.0001*
Format	.0081*
Format x Task	.1799

*significant value

"incorrect." Five of the 18 scores were the result of answers that did not match the information contained in the clinical guidelines. The percentage of incorrect responses was tabulated for the various tasks and formats and the results were analyzed. The ANOVA for SCORE found significant differences for task and format (Paper: 27/32 perfect scores, or 85%; Intranet: 19/32 perfect scores, or 59%), but not for format by task. The R-Square value for this analysis was .64 (Table 3). This result implies that there was a significant difference in the mean score across the four tasks, where tasks completed using the paper version had a higher percentage of perfect scores than those completed using the intranet version of the guidelines.

Finally, an ANOVA was performed to determine whether mean EASE scores differed across subjects and/or formats. Subjects were asked to rate the paper and intranet guideline versions for "ease of use." For each version, participants placed a vertical mark along a 100mm VAS, where 0 corresponded to "EASY" and 100 corresponded to "DIFFICULT." The mean EASE score for the paper version was 42.8 (SD=17.1). The mean EASE score for the intranet version

Table 3. ANOVA for SCORE across task and format

Factor	Pr>F
Task	.0001*
Format	.0052*
Format x Task	.2606

*significant value

was 46.6 (SD=15.0).While these scores varied significantly from subject to subject, there was no significant difference across format. This result implies that mean EASE scores were not different for the two guideline implementation methods.

Discussion

This study was undertaken to determine if differences in efficiency and/or effectiveness exist for two methods of clinical practice guideline dissemination. The study also attempted to evaluate the methods on their subjective ease of use.

Mean task completion TIME values were significantly longer for the intranet than they were for the paper version (Intranet=6.7 minutes; Paper=5.7 minutes). In addition, the percentage of tasks with perfect SCOREs was higher for the paper version (Paper=85%; Intranet=59%). There was no significant difference found in EASE between the two formats. These results contradict the hypotheses set forth in the beginning of this study.

The fact that TIME values were greater for the intranet helps to explain why a greater percentage of tasks that were completed with the paper guidelines had perfect scores. In most cases (i.e. for 13/18 incorrect responses), questions were scored "incorrect" because they were left blank. This implies that the subject ran out of time prior to completing all questions. Since intranet tasks took longer to complete and since incomplete answers were scored in this way, it follows that a significantly lower percentage of intranet tasks had perfect scores.

It was postulated that the inherent tools of the Internet, such as a "search engine" and hypertext, would have a perceived impact on the efficiency, effectiveness, and ease of information gathering from an intranet guideline dissemination system. Specifically, it was hypothesized that subjects using the

intranet version of the guidelines would be able to locate information faster (as measured by TIME), more efficiently (as measured by SCORE), and with greater ease (as measured by EASE) than subjects who completed the same tasks using a binder of paper guidelines. These hypotheses have been disproved.

Many of the issues relating to the choice of using a clinical knowledge resource revolve around the time involved with using it and its proximity to the user. This fact likely stems from the limited time clinicians normally have to research clinical questions, and the "time-costs" associated with clinical resources currently available to users. Some investigators have argued that resource availability plays a major role in its usefulness to clinicians (Connelly 1990; Curley 1990). Others have argued that the urgency of the patient's problem also plays an important role (Gorman and Helfand 1995). Computerizing relevant clinical information has been suggested as a means to aid in the rapid access of information and to solve the problem of time-costs and availability (Osherhoff 1991).

While clinical practice guidelines were developed to provide a convenient interface to clinically relevant resource material, to date, they have not been widely used by health care professionals. Numerous factors have been proposed to explain this phenomenon (Grimshaw and Russell 1993). In addition to the manner in which guidelines are developed, implementation is also an important factor. Providing general feedback and reminders has been found to be less effective than providing patient-specific reminders *at the time of consultation*.

However, the results of this experiment argue against the contention that simply placing clinical guidelines on a computer is the answer. Yet, while placing guidelines on a computer network is not the ultimate solution, it may be an intermediate step in the right direction.

As the medical record continues to migrate toward electronic implementation, the opportunity to integrate electronic guidelines into the process of care will become a reality. Kaiser Permanente Northwest has already begun to move in this direction. By providing reminders to clinicians at the point of care (e.g. when ordering a medication on the electronic chart), and including hypertext links to an appropriate intranet guideline, the advantages to users become lucid. The reminder serves as a means to impact clinical practice patterns by providing alternative suggestions at the clinical decision point. Linking reminders to full-text guidelines gives a clinician the opportunity to ponder the reminder further by gathering as much detail as necessary.

Limitations

Setting

Any time one attempts to study natural behavior in an experimental setting, there is the risk that the results may not be generalizable back to the natural setting in question. This study is no exception. In normal clinical practice, clinicians may formulate specific clinical questions in their minds, and some may seek answers to such questions by referring to clinical guidelines.

Answers to these questions may or may not always be present in the guidelines, but this process differs from the current situation being examined. In this experiment, questions were simply given to each participant, and they were instructed to use the guidelines as their sole information source. This method was chosen because *how* or *when* clinicians choose to use guidelines was not the focus of this examination. Rather, the desire was to assume that there are instances when guidelines are used in everyday practice, and that it would be beneficial to know how the existing access formats compare.

Sample

This study must be interpreted with some reservations. There may have been sampling bias due to the nature of clinician recruitment (i.e. e-mail notification and the acceptance of only those who were already familiar with the technology being studied). However, it should be noted that no subjects were paid and no inherent differences from the sample population are currently known. The sample size for the experiment was small. Relying on a small sample of volunteers may have introduced bias, if the volunteers differed in some way from those who did not respond to the request for participation. In addition, the small sample size would have made significant subgroup analysis meaningless.

Many differences may exist within subsets of internal medicine and family practice clinicians. These characteristics may have important implications for the dependent variables measured in this study. For example, there were two

subjects who had never used clinical guidelines in their normal practice. These same two subjects also responded that they did not employ the use of search-aids when using the intranet guideline version. These subjects showed lower mean familiarity scores as well, but the small number in this subgroup makes it impossible to draw any conclusions about the effect of inexperience on task completion TIME or SCORE.

A question also arises concerning the possible differences across clinician type. Physicians, Nurse Practitioners (NP), and Physician Assistants (PA) were all represented in the current investigation, though there were only two NP's and one PA. It is impossible from this unbalanced representation to draw conclusions concerning any differences between these groups. If differences could be shown, it would be in the best interest of an investigator to study one of these groups separately, thereby eliminating the chance that a between-groups interaction would confound any true differences between the guideline dissemination formats.

Tasks

It was not surprising to find significantly different scores across all four experimental tasks. As no such tasks had been developed prior to this experiment, it was expected that such differences would be evident.

One example may serve to point out why the tasks likely confounded this interaction. In task B (Appendix A), question 3, subjects were asked about the long-term safety of Omeprazole, as discussed in the Acid-Peptic Disorders

guideline. This was the only case where the two guidelines differed in their content (at least with regard to this study). The paper guideline states that long-term use of Omeprazole may cause carcinoid tumors. The intranet version, which is the more current of the two guidelines, states that there are no known long-term safety hazards associated with this drug. Thus, the answer to this question differed depending on which version of the guideline was being used. It must be noted that answers were scored according to the information present in the guideline that was used. Thus, participants were not penalized for having out-dated information as their source. Question 3 was scored with respect to the correct answer as stated in whichever guideline version was used. While it is beyond the scope of this discussion, it may be feasible to conjecture that it would take longer for a subject to sift through a guideline to determine that certain information is *not* contained there than it would to locate an affirmative answer. It is unknown whether this one difference may have been enough to make the intranet searchers significantly slower than those using paper.

The tasks for this experiment were developed directly from the guidelines themselves. Once a significant piece of clinical information had been located, a question was developed that would require the participant to locate this information in a guideline. This process was used to ensure that all questions could be answered using the guidelines. Questions were designed to test the usability of the dissemination formats, and not to test the memory of participants in any way. While this method was useful for this experiment, it is obviously

different from the process that occurs in the natural setting. Not all questions that arise during patient care can be answered using clinical guidelines, and questions that do occur are normally derived from some aspect of the clinical case, not from some arbitrary source, such as the author of this study.

Finally, with respect to the experimental questionnaire, the ease of use questions should have been presented to participants both before and after the experiment. Asking these questions in this way would allow the investigator to examine the direct effect of the intervention upon this measure. For example if EASE scores for the intranet version dropped more sharply from the pre-test than did paper EASE scores, then a more profound statement could have been made regarding this measure.

Implications for future research

This exploratory study raises several questions for future research. Important questions needing to be investigated include whether there are significant differences among the subgroups suggested by this investigation. If significant differences exist between these subgroups, then the three dependent variables must be re-examined. If it can be shown, for example, that experience with Internet technology leads to marked improvement of TIME, SCORE, and EASE values for the intranet, then providing clinicians with the necessary expertise should become an objective of any organization that provides an electronic interface to clinical information. Researchers should examine whether

providing such training actually makes a substantial difference for users. If these factors do play a role, then perhaps a case could be made to initiate additional education for clinicians who use this tool.

As the computer-based patient record becomes more prolific, new strategies will be employed to take full advantage of the electronic environment. Among such strategies lies embedding guidelines directly into the patient record. As decision points arise, electronic reminders and guidelines could be automatically placed in the stream of problem-solving. Studies support the notion that using computer reminders at the pint of decision may have a dramatic impact on the behavior of clinicians (Tierney 1990 and 1993). Placing guidelines on an intranet already provides an easier method of data management for the organization and ensures users that they are accessing the most current material available. When systems advance to this level, it will be useful to re-examine what impact electronic guidelines have on the clinician. Does such seamless integration increase guideline use? Does providing the option to access such information at logical points in the medical decision making process make guidelines easier and more attractive to use? Such questions cannot currently be answered, but will be important points of departure for further research in this area.

Conclusions

This study does not support the contention that simply placing clinical practice guidelines on a computer network solves the problems that currently face guideline users. At the present time, the tools provided in an electronic environment are not enough to allow more efficient or effective guideline retrieval. Nor does the intranet guideline system improve ease of use. While placing such information on the clinician's desktop computer brings it closer to the user, it is still not integrated into the decision making process. Computerization may be a necessary step, but the process of improving guideline accessibility does not end there. Guidelines must be integrated directly into the flow of decision making. When that step is realized, then not only will guidelines be more logically and conveniently accessible to users, it will provide an important opportunity to positively impact the clinical decisions of those users.

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Appendix A:
Experimental Tasks A-D

CASE A:

Each of the following questions will ask for specific, guideline stipulated information regarding congestive heart failure as a result of left-ventricular dysfunction. Please answer each question according to its specific context (i.e., none of the questions are necessarily related to each other). Please contact the proctor if you complete the questions before your allotted time expires.

Questions-

1) Does the guideline recommend hospitalization for a patient with recurrent CHF, who presents with hypotension: YES NO

2) If aortic stenosis is suspected, what does the guideline recommend regarding ACE Inhibitors?

_____

3) List 3 of 6 items that the guideline suggests you should discuss with the patient's family:

_____ _____ _____

4) List 3 of 7 adverse reactions, according to the guideline, that accompany the prescription of ACE I:

_____ _____ _____

5) This question has two parts. When prescribing the Loop Diuretic Ethacryinic Acid, what is the guideline recommended initial dose? What is the recommended maximal dose?

Initial: _____ Maximal: _____

CASE B:

Each of the following questions will ask for specific, guideline-stipulated information regarding acid-peptic disorders. Please answer each question according to its specific context (i.e., none of the questions are necessarily related to each other). Please contact the proctor if you complete the questions before your allotted time expires.

Questions-

1) Regarding the prescription of Omeprazole (Prilosec), please list 2 of 4 inappropriate uses, as listed in the guidelines:

_____ _____

2) You suspect gastroesophageal reflux disease but determine that there is no dysphagia. You begin by treating with Gaviscon (and appropriate lifestyle changes) and later switch to Cimetidine therapy, however, the symptoms persist. According to the guideline, please list the a) drug, b) dose, and c) duration of the next recommended treatment:

Drug: _____ Dose: _____ Duration: _____

3) Regarding the medical therapy Omeprazole, does the guideline list any concerns regarding its long-term safety? **YES** **NO**
If you answered YES, please list the concerns (if NO, please go on to question #4):

_____

4) You suspect NSAID-induced UGI symptoms and the patient presents with anemia. Upon further testing (UGI series), you determine that the patient has an NSAID-induced ulcer. In the case where this patient has had a duodenal ulcer in the past, which drug does the guideline recommend as a protective measure against recurrent duodenal ulcer?

_____

5) According to the guidelines, what is the Kaiser cost to treat with 150mg Rantidine (Zantac) twice a day, for acute treatment, relative to the prescription of Tagamet?

_____

CASE C:

Each of the following questions will ask for specific, guideline-stipulated information regarding acid-peptic disorders. Please answer each question according to its specific context (i.e., none of the questions are necessarily related to each other). Please contact the proctor if you complete the questions before your allotted time expires.

Questions-

1) Please list 2 of the 5 headache alarms, as listed in the guidelines:

_____ _____

2) According to the guideline, prophylactic therapy for frequent headaches is recommended for which patients?

_____

3) For a patient suffering from cluster headaches, please list 3 of 6 guideline recommended reversal therapies:

_____ _____ _____

4) As a reversal therapy, you prescribe sumatriptan (Imitrex) tablets. Please list the guideline recommendations for a) onset dosage and b) max. dosage per day.

onset: _____ max. dose: _____

5) Regarding prophylactic treatment with calcium channel blockers, what does the guideline list as relative contraindications (2):

_____ _____

CASE D:

Each of the following questions will ask for specific, guideline stipulated information regarding low back pain. Please answer each question according to its specific context (i.e., none of the questions are necessarily related to each other). Please contact the proctor if you complete the questions before your allotted time expires.

Questions-

1) As a treatment for low back pain, salsalate (Disalcid) is one of the appropriate drugs. The Kaiser cost, relative to Motrin, is listed in the guidelines as:

_____

2) When treating low back pain with the muscle relaxant, Robaxin, what does the guideline prescribe as the normal dose?

_____

3) A female patient with mild low back pain asks for your advice on lifting weights. According to the guideline, how much can she safely lift?

_____

4) A patient fails to improve after 6 weeks of conservative management and self-care activities. According to the acute low back pain protocol guideline, there are at least two suspected conditions that would warrant a CT scan, please list them:

1) _____ 2) _____

5) According to the flare management section in your guidelines, if a patient is experiencing acute flares of backpain, bed rest should be limited to how many days?

_____

Appendix B:
Clinician Survey and Verbal Questions

Guideline Use Questionnaire (Please print legibly)

1) Are you: _____ Female _____ Male

2) Please list your age: _____

3) Please list your specialty/practice type: _____

4) How long have you been a practicing physician? _____

5) How long have you been practicing with Kaiser Permanente? _____

6) Please rate your experience with computers by placing a vertical mark on the following scale:

_____

NOVICE EXPERT

7) Have you ever used Kaiser Permanente's clinical guidelines in your practice:

YES NO

If you answered NO to question 7, you may skip to question number 12.

8) Please list the number of times per month, on average, that you consult the guidelines: _____

9) Which form of the guidelines do you prefer to use (circle one):

PAPER INTRANET BOTH

If you answered BOTH, please explain when you use the different versions:

_____

_____

10) Please draw a vertical line on the following scale to rate guideline usefulness:

_____

NOT USEFUL VERY USEFUL

11) Please draw a vertical line on the following scale to rate how much guideline use has impacted your practice:

NO IMPACT LARGE IMPACT

***For the remaining questions, please draw on your experience with clinical guidelines either from actual practice, or from your experience during this study...**

12) Please rate the PAPER guidelines for ease of use by placing a vertical line on the following scale:

EASY TO USE DIFFICULT TO USE

13) Please rate the INTRANET guidelines for ease of use by placing a vertical line on the following scale:

EASY TO USE DIFFICULT TO USE

14) Do you prefer a "short" guideline, consisting of an algorithm and its essential notation, or a "long" guideline that contains a full textual description of the subject matter in question (please circle one)?

SHORT LONG DEPENDS NO PREFERENCE

Comments (optional):

15) In your opinion, is the current Intranet guideline system robust enough to replace the paper version?

YES NO

16) Please comment on improvements (if any) that should be made to the current guideline system:

_____

_____

_____

17) The following space has been provided for any further comments you may have:

_____

_____

_____

Verbal Questions (the following two questions were asked of each participant)

1) "When using the intranet version of your clinical practice guidelines, did you use any of the available search-aids (for example: the FIND feature, the search-engine, or any of the internal hypertext links)?"

2) "On a scale from zero to ten (where 0 corresponds to 'Not Familiar' and 10 corresponds to 'Expert'), how would you rate your familiarity with either the Kaiser intranet/Internet as an information gathering tool?"