Use of the Critical Incident Technique
to Evaluate the Impact of MEDLINE

Final Report

September 30, 1989

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Norma Starr-Schneidkraut, Ph.D., Project Coordinator
Michael D. Cooper, Ph.D., Consultant

Submitted to

Elliot R. Siegel, Ph.D., Project Officer
Office of Planning and Evaluation
National Library of Medicine
8600 Rockville Pike
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USE OF THE CRITICAL INCIDENT TECHNIQUE TO EVALUATE THE IMPACT OF MEDLINE

EXECUTIVE SUMMARY

BACKGROUND

The NLM has an ongoing responsibility to assess the extent to which its information products and services support the requirements of its users. This enables the Library to craft ever more responsive systems that capitalize on the latest advances in information and computer technology and, when necessary, to modify existing systems whose performance may no longer be optimal or consistent with the functions intended. The importance of this requirement was underscored in the recent report of the Outreach Planning Panel to the NLM Board of Regents.

A fundamental concern is the need to identify the impact of MEDLINE-derived information—i.e., does the use of MEDLINE "make a difference"? In what ways is it used, and with what effect? In particular, is information retrieved from MEDLINE used successfully by health professionals to support medical decision-making and patient care? Previous efforts to address this question have been limited to the collection of available anecdotal reports. Traditional survey methodology, with pre-defined response categories, while used effectively to determine general areas in which MEDLINE information is used, is not well suited to developing a detailed understanding of user motivation, behavior, and resulting consequences.

In August 1988 the NLM's Office of Planning and Evaluation, with the support of the American Institutes for Research (AIR), Palo Alto, California, launched a unique study employing the Critical Incident Technique (CIT) in an attempt to address this problem in a scientific manner. This was the culmination of a year-long planning effort by NLM senior management and an in-house study group which designed the study, carried out a pilot test, and obtained the final clearances.

The CIT methodology was originally developed by Dr. John Flanagan and his colleagues in the Aviation Psychology Program of the Army Air Corps during World War II. It was used extensively in studies to improve flight crew selection, training, and combat performance. The technique has been utilized in more than 700 published studies since that time, including a 1960 study undertaken by AIR for the National Board of Medical Examiners in which the CIT was used to collect examples of effective and ineffective clinical practice by interns and residents for the purpose of defining the critical dimensions of clinical competence, and thus to revamp Part III of the NBME certification examination. The CIT has also been used extensively in other studies to define the requirements for effective performance in various medical specialties such as orthopedic surgery and child psychiatry, and in studies to delineate the outcomes of medical care.
METHODOLOGY

Sample. The approach taken was to schedule, by mail, personal telephone interviews with random samples of various types of health professionals who are known MEDLINE users--persons who search the NLM database directly as "end-users," or who employ the services of a medical librarian ("mediated users"). A sample of 782 end-users, identified by means of an earlier NLM survey and current subscriber records, was invited to participate in the evaluation; 361 of these persons were ultimately interviewed. Two Regional Medical Libraries participated in the identification of mediated users with differing mixtures of professional activities. From among 188 invitees, the University of Texas Southwestern Medical Center in Dallas carried out interviews with 81 health professionals on that campus who had requested MEDLINE searches to be performed by the Library's reference staff during the previous year. A sample of community physicians not primarily associated with an academic health sciences center, who had requested searches by medical librarians in small to medium-sized community hospitals, was also obtained. This was accomplished with the assistance of the UCLA Biomedical Library, whose staff requested the names of candidate interviewees from librarians at 21 community hospitals in California and other states in Region 7. From among 199 invitees, interviews were completed with 110 persons.

In sum, of 1,169 health professionals invited to participate in the study, 552 (or 48% of the total of 1,160 ultimately determined to be eligible) were successfully contacted and interviewed in telephone sessions averaging 30 minutes in duration.

Questions. A CIT interview session is specially structured to obtain reports of behaviors leading to successful or unsuccessful outcomes on a task or process. As used in the present study, a series of open-ended questions were developed which were intended to obtain detailed reports of specific MEDLINE searches carried out by or for the interviewee. The questions were designed to identify: (a) the individual's motivation for searching the MEDLINE database on that occasion; (b) the impact of the obtained information on the individual's decision-making; and (c) the ultimate impact of the information on the outcome of the situation that occasioned the search (e.g., the actual outcome for the patient involved).

AIR staff (and collaborating staff of the University of Texas) opened each interview session with the question, "Can you think of a recent instance in which the information you obtained through a MEDLINE search you conducted [that was conducted for you] was especially helpful [unsatisfactory/not helpful] with your work? Do you have a specific search in mind?" Depending upon whether the interviewee intended to report an effective or ineffective search, performed as an end-user or by a librarian, one of four parallel interview protocols was used.

The End User/Effective Search protocol asked the following open-ended questions, along with additional probes as needed to obtain sufficiently detailed descriptions:

What was the situation that led you to do this search? What specific information were you seeking? Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? How did you carry
out this search to get the information you needed? What information did you obtain as a result of this search? In what specific ways was this information helpful in your decision-making? What was the impact on the situation of having this information? What was the outcome of the situation?

A second set of questions with pre-coded response options was asked for the purpose of characterizing the interviewee on such variables as specialty, work setting, community size, and the nature and extent of MEDLINE searching experience, and of further characterizing both the context in which the search occurred and the search process.

**Data Analysis.** Four types of analyses were performed on the 1,158 Critical Incident Reports that were obtained from 545 interviewees (7 of those interviewed had no incidents to report). The primary analysis of these data consisted of the qualitative analysis of the incident text from three different frames of reference in order to create three hierarchically organized inventories or "taxonomies" of (1) the reasons why information is sought from MEDLINE; (2) the effects of the information obtained on the decisions and actions of the originator of the search; and (3) the ultimate impact of having (or not having) the desired information on the outcome of the situation that occasioned the search. Several successive trials and refinements were required in the pretest and initial phase of the data collection until the three frames of reference were distinct and the interview questions and probes were such that they resulted in the detail needed in order to unambiguously characterize each incident on each of the three key elements -- why the information was needed, its impact on the actions and decisions of professional activities, and its impact on the outcome of the situation. The analysis began with the creation of three brief (one-sentence) statements summarizing a given incident report, one for each of the three different frames of reference being considered. Considering one frame of reference at a time, essentially identical statements related to that frame of reference were grouped together and then the categories defined by these sets of statements were progressively organized, at successively broader levels, into an evolving taxonomy. At the finest level of the taxonomy, the goal was to maintain as many potentially useful distinctions among the categories as possible. These detailed statements were then organized into successively broader categories, resulting in the outline form of the final taxonomies. As unique statements were generated from the incident reports, new categories were added at appropriate points in the developing outline. In all three cases, the numbers of incidents were such that the addition of incidents eventually failed to produce additional new statements and categories, and it could be concluded that the three taxonomies were comprehensive of all of the relevant reasons for searching and types of impact.

In addition to the three inventories, a less formal qualitative analysis also was carried out of the reasons given for choosing to do a MEDLINE search instead of or in addition to asking colleagues, consulting textbooks, or searching the individual's own reprint files or journal collection. Since respondents approached this question in various ways, the analysis eventually led to the identification of why individuals chose to go to the journal literature as opposed to other potential sources of information, why they chose to do so via an automated search system, and, where applicable, why they specifically elected to search using Grateful Med.
A second type of analysis consisted of straightforward tabulation and cross-tabulation of the information recorded on the back of each incident form—the information concerning details of the search situation and the respondent's characteristics. A third type of analysis was aimed at verification of the data collection process and the incident reports—a comparison of selected transcriptions of the audiotaped interviews with the written incident reports, and a comparison of MEDLINE system transaction logs with the primary parameters of the search session as described by the interviewee. Finally, those searches characterized as ineffective by the respondent were compared (where possible) with a corresponding transaction log, and a parallel search aimed at obtaining the desired information was carried out by an expert MEDLINE searcher.

RESULTS

The reports given in these interviews indicate that the NLM's MEDLINE database—and the Grateful Med software that extends its reach to the homes and offices of potentially every physician in the nation—is used with a remarkable diversity of medical need and positive effect. Information obtained from MEDLINE has had extremely important consequences for patients, for the progress of biomedical research, for the quality of education received by health professionals in training, for the safety and effectiveness of health care institutions, for the operation of the system of third-party reimbursement, for legal decisions, and for the knowledge of the public.

Health professionals search an online database for its convenience, speed, thoroughness, currency, efficiency, and capacity to identify the most authoritative information—when compared to alternative information sources, including journal reprint collections, textbooks, and colleagues. Respondents also noted the advantage in timeliness afforded by Grateful Med, in that it permits searches of MEDLINE outside normal library hours and/or at the precise time of need.

Why Information was Needed from MEDLINE. The analysis of the incident reports resulted in a detailed enumeration of the reasons respondents gave for needing information from MEDLINE. With respect to Patient Care, for example, these needs spanned diagnosis and etiology; treatment and prognosis; the physician-patient relationship; disease prevention; and third-party payment. Within each of these categories, more specific types of need were identified, each illustrated by one or more specific extracts from an actual Critical Incident Report. For example:

I. Patient Care

A. Diagnosis and etiology

1. To utilize diagnostic tests and procedures

a. To help select an appropriate test(s) to diagnose some condition or establish a differential diagnosis [17 incidents]

   • "Had patient with symptoms that could have been chronic granulomatous disease and wanted information
on appropriate test to detect this enzyme defect in white blood cells"

**Impact on Medical Decision-Making.** The analysis of the impact of information on the individual's decision-making identified a wide variety of effects on professional activities similar to those that characterize the reasons for needing information. At the broadest level, these grouped into six areas: Patient Care, Research, Teaching, Learning, Administration, and Consultation. As an example of the more specific types of impact identified within the Patient Care area, in the second category, B, can be found the following example:

I. Patient Care

A. 

B. Recognized and properly diagnosed a medical problem or condition

1. ...

2. Arrived at a differential diagnosis

   a. ...

   b. ...

   c. Eliminated or was helped in eliminating a possible diagnosis/cause of a medical problem [17 incidents]

   • "Failure to find any reports of exercise-induced pancreatitis helped physician rule this out as a cause (of pancreatitis) in an adolescent patient who collapsed during a foot race."

**Impact on the Outcomes of Professional Activities.**

Even more than the previous "decision-making" taxonomy, the "outcome" taxonomy makes it clear that the information obtained via MEDLINE has had important beneficial, even life-saving, consequences. Such life-saving incidents were reported by eight respondents, including the following example:

I. Patient End Results

A. Longevity

1. Life of patient(s) saved [8 incidents]

   • "Case reports of a rare and usually fatal fungal infection and suggested treatment were used by physician to choose treatment (IV miconazole) for a patient with a brain abscess due to this fungal infection. Patient has survived for two years, but would have received the wrong treatment and almost certainly would have died if this treatment had not been located."

MEDLINE-derived information also was determined to have had other important economic impacts in the form of decreased cost of care, appropriate payment and/or denial of insurance benefits, and avoidance of patients' income loss.
Characteristics of Searches and Respondents. Of the 1,158 incidents reported, 991 (86%) were self-characterized by respondents as effective in terms of their impact on professional activities, while 167 (14%) were characterized as ineffective--approximately the same proportions for both end-user and mediated searches. And it is very clear that MEDLINE is used to support patient care. At least 77% of the study participants spent some portion of their time (an average of 60%) on patient care activities; and 45% of the reported searches were performed in response to a patient care information need.

Grateful Med was the mode of MEDLINE access for 54% of the end-user searches. Slightly over one-half of the end-user searches were performed from physicians' offices and most of the remainder were done from their homes (41%). It is important to note that these proportions, and all other quantitative descriptions of searches and respondents contained in the full study findings, should not be considered unbiased estimates of the experiences and characteristics of the total population of MEDLINE users. Persons sampled in a CIT study are selected in such a way as to insure the reporting of all possible outcomes, and not necessarily on the basis of their proportional representation in the population. Moreover, in obtaining the accounts of specific incidents, respondents are purposely asked to relate particularly noteworthy, rather than typical, incidents.

CONCLUSIONS AND IMPLICATIONS

This study has generated detailed accounts of MEDLINE searches--their purpose, how they were carried out, what information was obtained as a result, how it was used, and with what ultimate effect. From a methodological standpoint, the effort has been highly successful. Physicians and other searchers were responsive to being asked to provide the information. The results, as recorded, were sufficiently detailed and medically accurate to support the development of three separate taxonomies and of descriptive case study abstracts. The only shortcoming, not entirely unexpected, was the evidence that respondents' unaided recall of the mechanics of how a search was carried out cannot be relied upon as an accurate system diagnostic aid by itself, in the absence of transaction log data.

Substantively, the study findings may be used by NLM to great advantage:

- The inventory of reasons for searching MEDLINE, empirically derived and systematically organized, provides an in-depth understanding of user motivations and needs that should be helpful in the Library's efforts to train users and to improve its array of information products and services.

- The inventory of various reasons why individuals turn to MEDLINE as an information resource clarifies the specific limitations of other sources of biomedical information (e.g., textbooks, personal reprint collections, colleagues), and highlights the unique benefits and value of MEDLINE which should be exploited in future product development.

- The detailed inventory of ways in which MEDLINE-derived information is used for medical decision-making provides ample
evidence that the system is extremely useful at all levels of research, education, and patient care. Based as it is on actual experiences, this information should prove helpful in communicating to policy makers and potential users the practical value of this vital NLM service.

- The inventory of outcomes, reinforcing as it does the very direct ways in which accessing the medical literature via MEDLINE can save lives and reduce health care costs, suggests strategies for empirically documenting cost savings by those health professionals who use MEDLINE information.

- The special analysis of the "ineffective" searches revealed important ways in which current MEDLINE and Grateful Med users may use search strategies that are sub-optimal. Failure to use MeSH properly was a relatively common reason behind ineffective searches. And such problems may be amenable to remedy by new user training techniques and/or by specific system enhancements.

- Finally, as NLM intensifies its outreach efforts, focusing on specific user communities such as students, minorities and other underserved populations, the Library now has at its disposal a comprehensive resource that can guide the conduct of information needs assessments with these groups, and can help evaluate the effectiveness of new initiatives to improve their access to health information.
INTRODUCTION

The Mission of the National Library of Medicine

The National Library of Medicine, henceforth referred to as "NLM" or "the Library," is mandated by Congress to assist in the advancement of medical and related sciences and to aid in the dissemination and exchange of scientific and other information important to the progress of medicine and to the public health. Its ultimate purpose is to improve the health of the American people by providing more effective access to health information for health professionals, scientists, educators, students, and decision makers in agencies affecting the nation's health. In support of its mandate, the Library developed MEDLARS (Medical Literature Analysis and Retrieval System), an automated database management system, in the 1960's, and in the 1970's pioneered in offering MEDLINE (MEDLARS Online), the first online database to be made available on nationwide telecommunications networks.

NLM Evaluation Activities

The Library accepts an ongoing responsibility to assess the extent to which its information products and services support the requirements of its users. For the first 20 years that MEDLARS was available, its principal users were medical librarians who functioned as database intermediaries for health professionals who needed to locate information in the health-sciences literature. In contrast, individual health professionals today are increasingly using personal computers to access MEDLINE directly as "end users", and, to assist them, the Library has developed a "user friendly" front end, Grateful Med, specifically designed to facilitate end-user searching. To obtain detailed information about this growing and important user population, their information needs, and their level of satisfaction with the present system, NLM conducted a nationwide survey in 1987 of nearly 3,000 health professionals who use MEDLINE directly.1 One important outcome of this survey was to underscore the importance of MEDLINE searching for patient care.

The above survey, however, was not the appropriate means for developing a detailed understanding of what impact the information retrieved via MEDLINE was having on the professional activities of health professionals. Such surveys did not reveal why the information was being sought through MEDLINE, to what use it was being put, or what its ultimate impact was on the situation that motivated the search. To fill this gap, the Library began an investigation of whether the Critical Incident Technique, a methodology developed to reveal the critical behavioral requirements for success in an activity would provide the answers to such questions.

The Critical Incident Technique

The Critical Incident Technique (CIT) was developed by John C. Flanagan, Ph.D., during World War II in the course of studies carried out under his direction in the Aviation Psychology Program of the U.S. Army Air Force.23 The technique, which is actually a set of related methodologies, involves the collection of detailed
reports of instances ("incidents") in which an individual did something that was especially effective or especially ineffective in achieving the purpose of an activity. The incidents must be collected, by interview or written record, from persons who personally observed the actions of the individual. To yield valid data, such observers must also be persons who are qualified, by virtue of their training and experience, to discern whether the outcome of the action affected the achievement of the given purpose beneficially or otherwise, and whether it was the individual's action, rather than other factors, that was in fact "critical" to the outcome. The use of the term critical in this context has been led to some confusion; it should be clear that, as used here, it refers to the pivotal role of the behavior in the outcome of an activity and not to whether the situation itself was an emergency, a matter of life and death, or critical in some other sense.

The collection and careful analysis of a sufficient number of detailed reports of such observations of effective and ineffective behaviors results in comprehensive definition of the behaviors that are required for success in the activity in question under a wide range of conditions. These organized lists of critical requirements (generally termed performance "taxonomies") can then be used for a variety of practical purposes such as the evaluation of performance, the selection of individuals with the greatest likelihood of success in the activity, or the development of training programs or other aids to increase the effectiveness of individuals. And it has been demonstrated in many arenas that the use of empirical data on behaviors that actually make a difference to the outcome of an activity, provides a more comprehensive, specific, and valid basis for performance evaluation, selection, etc. than does a set of requirements based solely upon the opinions of experts.

The Critical Incident Technique has been widely used in defining the critical requirements of performance in the health professions. Beginning in the mid-1950's and continuing over the next 20 years, a series of studies was carried out by staff of the American Institutes for Research and others to define the requirements for safe, effective nursing performance. Then, in 1960, AIR completed a study for the National Board of Medical Examiners that gave, for the first time, a concrete definition of the requirements for effective performance as a physician -- specifically, a medical resident. This was followed by a number of similar studies, generally carried out under the auspices of the relevant boards, to define the critical requirements for performance in various medical and nursing specialties. Among the most well-known are the studies in orthopedic surgery and child psychiatry.

The CIT Pilot Study

In 1987 NLM consulted with a number of individuals, including persons who had used the Critical Incident Technique in other settings, and formed a special study group to consider the feasibility of applying the Critical Incident Technique as an evaluation methodology to the problem of assessing the effectiveness of the retrieval and use of biomedical information by health professionals.

In October of 1987 a Focus Group consisting of 13 physicians engaged in patient care in a variety of settings was convened at NLM for the purpose of reviewing draft CIT interview questions and providing advice on a variety of procedural issues that would need to be confronted in a larger study. As a result of this very useful session, the interview questions were revised and refocused to address MEDLINE use specifically and the planned pilot study was redesigned to
focus on a restricted sample of physicians who were identifiable as MEDLINE users. This was also instrumental in designing the research instruments for which NLM obtained OMB clearance.

Subsequently, 37 physicians among a sample of 50 drawn from respondents to the MEDLINE Survey of Individual Users, were interviewed personally by the NLM Assistant Director for Planning and Evaluation by phone to determine (1) whether they used MEDLINE to help with problems related to their practice of medicine, and if so, in what way; (2) the nature of a specific, recent instance in which MEDLINE was especially helpful in this regard; and (3) an instance in which MEDLINE was unsatisfactory or did not help them. Interviewees were also asked a number of questions that were designed to help in setting the sample size and procedures to be used in the full Critical Incident Study. The feasibility study was extremely useful in indicating that the supposed effective and ineffective incidents could and would be described by physicians, providing some indication of the nature of the types of reported uses and outcomes that might be reported, and assisting in the design of the larger study.

The Present Study to Evaluate the Impact of MEDLINE

Based upon the successful results of the pilot study, the NLM prepared and released a Request for Proposals to support NLM in the conduct of a larger study of the impact of MEDLINE use, using the Critical Incident Technique. The American Institutes for Research successfully bid on this evaluation support contract. The present document reports the detailed methodology of that study, its results, and the conclusions and implications of the results for the services of the Library.
METHODS

OVERVIEW OF METHODOLOGY

The application of the critical incident technique to the problem of defining the impact of MEDLINE had several methodological requirements. First, an appropriate sample of MEDLINE users had to be defined. The sample had to contain both professionals who search MEDLINE themselves in order to obtain information (the so-called "end users") and persons who have searches carried out for them by a trained search intermediary. And the sample had to be broad enough to encompass the widest possible range of professional activities and, hence, the widest possible range of reasons for searching. Specific procedures for sampling and recruiting the desired interviewees had to be defined.

The second requirement was the development of an interview protocol that would elicit the desired information on why the search was carried out, how it was carried out, what the results of the search were, and what was the impact of the information obtained as a result of the search. A particular issue was that the questions and probes in the interview protocol had to elicit very detailed and specific information, including highly technical details, in order to enable the analysis of each search report from several different perspectives, and to insure that the report was clear and unambiguous. A related problem was the determination of the specific form in which the interview narrative was to be captured in a written "incident report" that would constitute the actual raw data for subsequent analysis.

The "frames of reference" from which the data were to be analyzed also had to be defined. Each frame of reference involved looking at the incident with specific question or purpose in mind and constructing an inventory or outline (often referred to as a "taxonomy") within which all of the incident reports could be classified. In the present study, it was eventually decided that there were three distinct frames of reference that were of interest. These were (1) "Why was the information needed?", (2) "How did the information obtained impact the decision-making of the individual who needed the information?", and (3) "How did the information obtained impact the outcome of the clinical or other situation that occasioned the search?". Once the three frames of reference had been distinguished, procedures had to be specified for carrying out the analysis and taxonomy development.

Interspersed among these other requirements were the need to define the procedures to be used to train and evaluate the interviewers, procedures for carrying out and monitoring the interviews, both those conducted by AIR and by regional medical library staff, procedures for investigating the validity of interviewer's translation of the interview into the written incident report, and procedures for investigating the accuracy of certain of the facts reported in the interview concerning the execution of the MEDLINE searches. The verification of the interview documentation involved the preparation of a sample of verbatim interview transcripts and their detailed comparison with the corresponding incident reports. The investigation of the accuracy of the interviewee's reports of details of the searches involved the retrieval and analysis of MEDLINE "traffic logs" for the end user searches reported. Traffic logs are the electronic records of MEDLINE searches that are maintained for a relatively brief time by NLM. The limitations of this verification procedure also had to be defined, in terms of the numbers of searches for which matched logs could potentially be obtained, and in terms of the specific criteria to be used in evaluating the correspondence of the incident reports and logs. And finally, a special effort
was undertaken to try to shed light on the searches reported to have been ineffective from the users perspective -- why the desired results had not been obtained and what might have been retrieved. This required the definition of the procedures to be used by an expert searcher in carrying out a search with the same purpose, and, more importantly, the procedures to be used for comparing the results of the end user and the expert searches.

The following sections describe how each of these aspects of the study was carried out.
SAMPLE

Sample selection. The population of interest for this evaluation consists of physicians and others who search MEDLINE, either themselves (the so-called "end users") or via a trained intermediary ("mediated users"). For a critical incident study, the goal in establishing the sample is to incorporate the range of diversity of perspectives and experience necessary to insure that the incidents collected are comprehensive of all of the types of impact that information obtained via MEDLINE might produce. It is not necessary that the sample be randomly selected from the population of interest; in fact, it is often important that certain types of experience, and hence certain types of individuals, be over-represented. In any event, while quantitative data were gathered that can be used to describe the incidents and the sample from which the incidents were collected, these data, weighted or unweighted, do not yield unbiased estimates of the characteristics of the entire population of MEDLINE users, and it would be inappropriate to draw such inferences from these data.

The intent in this study was to collect approximately 1,200 reports of MEDLINE searches constituting "critical incidents" in the sense that they were helpful or not helpful to the user in carrying out his/her professional activities. Since experience suggested that individuals will generally provide 2-3 incidents each, in a wide variety of contexts, it was anticipated that approximately 600 interviewees would be required. Further, it was intended that the final sample should consist of approximately two-thirds (400) persons who are end users, and one-third (200) who typically request mediated searches. The assistance of the University of Texas and UCLA Regional Medical Libraries was sought in identifying mediated users who could be interviewed.

Construction of the sample of "end users" began with a listing of all 4,311 persons identified as potential or probable NLM "end users" as of August 1, 1987. In the fall of 1987, these individuals were surveyed by NLM concerning their MEDLINE use. Of the 2,037 who responded and indicated a willingness to participate in further studies of MEDLINE, 563 were randomly selected to be invited to participate in the present study -- 80 in the pretest phase and 483 in the main study.

End users are currently being added to NLM's system at the rate of over 200 per month. In order to include such recent additions and thus insure that some persons with less searching experience would be included, a second sample of 200 was drawn randomly from the group of 2,135 individuals identified as NLM "end users" involved in direct patient care or biomedical research, and who were issued access codes between August 1, 1987 and September 30, 1988. None of these individuals had been contacted previously by NLM regarding their MEDLINE use. Of these "new users," 20 were selected for the pretest phase and 180 more for the main study. This sample was drawn using the same algorithm as used for the survey respondents. In addition to the initial sample of 200 "new users," a sample of 20 individuals was randomly selected from among the 114 "new users" employed in health sciences education. This brought the total number of "new users" invited to participate in the study to 220.

The results of the pretest interviews suggested that the number of physicians in a simple random sample of MEDLINE end users would be sufficient to insure enough incidents related to patient care to support development of a comprehensive taxonomy of outcomes in this area, and hence no oversampling of end users with an M.D. degree was undertaken. The pretest also suggested that a participation rate of approximately 60% of the survey respondents and 40% for new users could be expected. The number of end user invitees for the entire study was thus set at 763 (563 of the survey respondents and 220
new users), with the goal of achieving the desired final sample of approximately 400 end users, consisting of 320 survey respondents and 80 new users.

Samples of "mediated users" were obtained in a somewhat similar manner. From their records of persons who had requested two or more literature searches within the preceding 11 1/2 months, the University of Texas (UTexas) Regional Medical Library selected all 128 of those with an M.D. degree who were at all involved in patient care, plus 60 others (40 MDs, MD/PhDs, or PhDs involved only in research and 20 nurses or other health professionals) in order to create a sample of approximately 188 potential interviewees, from which it was hoped that 90-100 actual interviews would be obtained. In this case, since the number of physicians requesting two or more searches was relatively low, they were oversampled.

The UCLA Regional Medical Library canvassed 21 community hospitals in their region and requested names and contact information from each hospital for 10 persons who had requested literature searches in the preceding month (or two months if necessary to obtain 10 names). An explicit protocol was given to each hospital to insure a random selection when more than 10 names were available. From these lists, provided by 20 of the hospitals, a sample of 199 individuals was selected to be invited to participate, in the expectation that half (100) would actually be interviewed. The majority of these individuals were expected to be physicians in community-based practice.

**Recruitment.** In the case of the end user sample, invitation letters were sent over the signature of Elliot Siegel, Ph.D., Director of Planning and Evaluation/NLM, to 563 survey respondents and 219 new users. The letter (see Appendix A) described the purpose of the study and the importance of their participation. For the UCLA-selected sample of mediated users, the letter also mentioned the name of the librarian in their local hospital who had provided their name. Included in both cases were response forms for the invitees to return directly to NLM to indicate whether or not they were willing to participate and optimal times for their interview. A second mailing was sent to invitees who did not respond within two weeks, and there was subsequent phone follow-up of nonrespondents until the cutoff date.

Recruitment of the UTexas sample of mediated users included an invitation letter essentially the same as that sent to the survey respondent/end user sample except that it was sent out under the signature of Ms. Jean Miller, the Director of the Library, with a copy of a letter of support from Dr. Siegel. Instead of a mail-back response form, the interviewer telephoned each invitee to schedule a phone interview.

**Response rates.** Of the 782 invitation letters mailed by AIR to 563 survey respondents and 219 new users, a total of 494 response forms were returned. Of those that were returned, 8 were inappropriate to the sample (librarians) and 48 were "regrets." Of those agreeing to an interview, eleven (11) ultimately declined to be interviewed, leaving a total of 427 potential interviewees, or a total agreement rate of 55% of the known eligible invitees. Of the 427 potential interviewees, 361 were actually interviewed prior to the cutoff date. Of the 199 invitation letters mailed to UCLA invitees, 125 response forms were returned. Of the total, one was ineligible for the study and 7 were "regrets." The remaining of 117 potential interviewees yield an agreement rate of 59% of known eligible invitees. Of the 117 possible interviewees in the UCLA sample, 110 were actually interviewed prior to the cutoff. The remaining 74 persons in the NLM and UCLA samples who had responded and agreed to an interview were called repeatedly, both at their preferred times and subsequently, without being able to make contact. Hence the ultimate
interview rate for all 972 known eligible persons in the sample to be interviewed by AIR was 471/972, or 48%.

Of the 188 UTexas invitees, 41 declined to be interviewed. Fifty were never reached by telephone or declined to be interviewed when contacted at the scheduled time. Sixteen letters were returned as undeliverable. A total of 81 individuals eventually were interviewed, an interview success rate of 43%.

In total, 552 interviews were completed. This is 48% of the total known eligible interviewees (N=1160).
DATA COLLECTION PROCEDURES

Protocol development. An early pilot test version had been developed and used by NLM in order to evaluate the feasibility of the study and aid in its design. The initial protocol for the present study utilized this early version but incorporated revisions based on input from AIR and NLM. These new protocols included a standard introduction to be read by interviewers, with interview forms tailored to the nature of the search (end user or mediated) and to the nature of the incident, i.e., a search deemed by the interviewer to have been effective or ineffective in terms of its impact on their professional activities.

An initial pretest was then conducted by AIR staff from the NLM offices in October 1988. During this effort, which involved 38 interviews, NLM and AIR closely monitored the effectiveness of the protocols. As a result of this initial pretest, some immediate changes were made in the protocol. A total of 58 pretest interviews then were completed from the NLM and AIR offices, and after preliminary analysis of the resulting data, more substantial changes to the protocol were incorporated because it was evident to AIR and NLM that there was often a lack of information, especially on the outcome of the situation, but also on the exact information being sought or how the information obtained affected the individual's decisions and actions. The changes were primarily made to insure that interviewers would obtain sufficient detail and specificity of information on all of the key aspects of the incident to allow for the creation of three different taxonomies. To do this, additional questions and suggested probes were added, and their importance and use was stressed in the interviewer training.

The revised protocols, as used in the subsequent data collection, are contained in Appendix B. In this protocol, the respondent was asked to recall specific MEDLINE searches—either effective or ineffective from their point of view—that had a significant effect on their professional activities. For each such search, a series of open-ended questions was then asked, designed to elicit a detailed description of the situation that occasioned the search, what information was being sought, how the search was carried out, what information was obtained, how it was helpful or (if appropriate) what information not obtained would have been more helpful, how the information (or lack thereof) affected the individual's decision-making, and what was the final outcome of the situation precipitating the search.

For each incident/search, a series of precoded questions was asked to insure uniform data on such items as when, where, and by whom the search was conducted, the setting in which the need for information arose, and certain attributes of the search process.

An additional series of precoded questions about the interviewee also appeared on each incident report form, but these questions were only asked once of each interviewee. They requested specific facts on the individual's professional activities, work setting, and size of the community served by their hospital or practice, and on the nature and extent of their experience in searching MEDLINE.

Interviewer training. Procedures for training the critical incident interviewers included familiarization with the critical incident technique, discussion of the specific application at hand, supervised practice interviewing, and careful review of samples of written records of subsequent interviews. Familiarization with the critical incident technique included a review of Flanagan's initial paper describing the technique and its uses, a review of previous applications of the technique to the health professions, and discussion of the general principles that apply to all applications.
During interviewer training, the discussion of the use of the critical incident technique in the current study of MEDLINE usage focused on the goals of the study and how they were related to both the introduction and the questions on the critical incident protocol. Supervised practice interviews were monitored by a trainer who listened to the interview in person or to a tape recording of the interview. The trainer then reviewed the written incidents produced, edited them, and discussed them with the interviewer with the goal of improving both the questioning and the written record.

An AIR staff interviewer spent three days in Dallas training University of Texas RML staff in the manner described above. Initial interviews and written incidents were critiqued on-site, and AIR staff subsequently compared tape recordings with written reports for 25% of the interviews conducted in Texas and provided detailed guidance and feedback.

In order to insure their familiarity with MEDLINE searching, and prior to conducting any interviews, AIR interviewers attended the three-day NLM MEDLINE training offered at the Regional Medical Library in Omaha, Nebraska.

**Interviewing procedures.** All of the non-pretest interviews were conducted between January 16 and April 28, 1989. AIR interviewers used the response forms from invitees to schedule telephone contact times, doing their best to accommodate the interviewees' schedules. At the outset of each interview, the interviewer introduced him/herself using a standard introduction. Permission to tape-record the interviews was requested and was granted in virtually all cases. The interviewer then proceeded to ask the interviewee to describe, in detail, instances in which information obtained via a MEDLINE search was especially helpful or not helpful in their professional practice, and recorded the interviewee's responses on the interview forms. Interviewers also recorded, on a separate sheet, any miscellaneous comments that were offered about experiences with MEDLINE or suggestions for improving the service. Reports of additional such searches were requested, and the interview proceeded until the interviewee had no significant searches to report or could not continue due to time constraints.

In general, the interviewers experienced a high degree of cooperation from the individuals contacted. Interviewees provided more numerous effective (i.e., helpful) than ineffective (i.e., not helpful) incidents, despite efforts to encourage them to relate any ineffective experiences with MEDLINE. Many initially felt that ineffective incidents would not be of interest to the study because they felt the problems they experienced were due to their own inexperience or ineffectiveness using MEDLINE. However, they were encouraged to report any such MEDLINE experiences that had an impact on their professional activities regardless of what they believed to be the cause of the problem.

To insure the quality of the interviews and the written incident reports, AIR and NLM instituted the procedure of listening to a sample of the tape recordings (5% of the AIR and 20% of the UTexas interviews) and comparing them with incident reports. This was concentrated at the beginning of the interviewing, so that useful feedback could be given. Complete transcripts of 6 interviews were created and compared with the incident reports in order to assess the level of accuracy and completeness of the reports.

Appendix C contains the transcripts of two randomly selected interviews, along with the incident reports resulting from these interviews. The only apparent error or inconsistency between the first report and its transcript occurred in item 14 on the back of the form, where the interviewer chose to record that the interviewee had previously
accessed MEDLINE via mediated searches, which was stated, but should have checked "Other" in response to the interviewee's statement that he had used Knowledge Index.

One apparent error in the first incident resulting from the second interview is the substitution of "nutritional support" for "nutritional work" in the response to the question about what information was needed. There is a slight difference in meaning (the latter suggesting a broader type of information), but it has no special significance for the use of the data. A second error seems to have been made in indicating that the first search reported was done in the hospital library. The respondent is a family practice resident at a large metropolitan medical center and medical school, but has rotations to a hospital and clinic in a rural area some distance away. The first search was done at the medical school library, not the local hospital; the second does appear to have been done at the hospital. Finally, the interviewer appears to have assigned the respondent's location incorrectly to a small SMSA on both incident reports. It should have been recorded as "non-metro 50+ K," rather than "SMSA <100 K" since the town is not part of the very large SMSA in which the medical center is located, or as "SMSA 1+ million." There is some inherent ambiguity in that the respondent is located in the large SMSA at times, and it is unclear whether the Crohn's patient was seen there or in the smaller community.

In general the level of inconsistency between tapes/transcripts was small and feedback was given to interviewers on the specific errors and types of discrepancies identified.

**Data processing.** Following the interview, the interviewer expanded the notes taken into a complete incident report, referring to the tape recording as needed. Those interviewers able to do so prepared the final text of the incident report as a word processing document; all other interviews were typed into a word processing system by a typist from the interviewer's handwritten draft. Typed copy of all incidents was affixed to the original data collection form, proofed by the interviewer, corrected and revised, and the final draft reviewed by the Project Coordinator or Project Director for inclusion in the analysis. In the process of this review 8 incidents were identified as too vague or incomplete to be included and were discarded.

A computerized database consisting of all invitees, each with a unique study ID number, was set up at the start of the study. When a response form was returned, the receipt date was logged in and the respondent was assigned to an interviewer. When the interview was completed and written up, the interview date, interviewer number and number of incidents obtained were entered into the computer database.

The backs of the incident forms were checked for completeness, photocopied, and sent to a keytaping service in batches, where they were keyed to an ASCII file on floppy disk. Fields were included for NLM ID number; AIR ID number; survey respondent, new user, UCLA or Texas respondent group; data collection round and mailing wave assignment, as well as other identifying data, to facilitate tracking of progress and analysis.
DATA ANALYSIS

Critical incident data. The primary analysis of the critical incident data consisted of the qualitative analysis of the incident text in order to create three taxonomies—hierarchically organized inventories—of (1) the reasons why information is sought from MEDLINE, (2) the effects of the information obtained on the decisions and actions of the originator of the search, and (3) the ultimate impact of having (or not having) the desired information on the outcome of the situation that occasioned the search. An analysis also was carried out of the reasons given for choosing to do a MEDLINE search instead of or in addition to asking colleagues, consulting textbooks, or searching the individual's own reprint files.

The initial analysis of the critical incident data was designed to help clarify the frames of reference to be used in developing the taxonomies. This involved the creation of three brief (one-sentence) statements summarizing each incident report, one for each of the three different frames of reference being considered: (1) why the individual needed the information, (2) the impact of the information on the decision-making of the individual, and (3) the impact of the information on the outcome of the situation. For any given frame of reference, those statements that were essentially identical were placed together, but the basic aim was to maintain as many potentially useful distinctions among the statements as possible, and to organize these into an outline form so that the detailed statements could be grouped in successively broader categories in a functional manner. Successive sets of statements were then examined, noting those that were unique and those that were identical to previously sorted statements. Unique statements were added at appropriate points in the developing outline, which led to periodic reorganization of the outline structure and number of levels. Eventually, statements were not actually written for every incident, but the process of grouping similar incidents and organizing the dissimilar sets continued until all incidents had been incorporated within a single outline.

Both the effective and the ineffective incidents were used in construction of the three taxonomies. In the first taxonomy—why the information was needed—there is no useful distinction to be made between the two types. It is only when the impact of not getting the desired search result is considered that any issue arises. In the case of the taxonomy of decision-making impact, the impact of ineffective searches could be stated, but in the negative, e.g., "was unable to decide whether surgery or medical treatment was more appropriate; had to obtain the information elsewhere." Such statements were typically the reverse of corresponding positive impacts, and both types of incidents were classified together, with the resultant statement being written in the positive form. In the two instances in which the search was ineffective and only a negative outcome was reported, the resultant statement was written in the negative.

It is theoretically possible that a search could have been judged to be ineffective and the resultant lack of information could have been pivotal in causing an adverse medical outcome for a patient, the use of an ineffective research protocol, etc. However, the fact is that physicians, researchers, and other professionals typically make every effort not to allow the failure to get information from a particular source to determine what happens to their patients, their research, and so on. And as a result, the impact of an "ineffective" search was either to cause the individual to pursue some other (possibly more onerous) avenue to get the information or to decide to redo the search later, with no discernible impact of the lack of information (or the delay) on the outcome of the situation that generated the search. Such reports were therefore treated as though they had "no outcome" and did not contribute to the taxonomy. Had any such untoward outcomes attributable to ineffective searches been observed, they would have been highlighted as noted above.
A few searches termed "ineffective" were really ones in which nothing was retrieved, from which the searcher concluded that the desired information, case reports, etc., did not exist. This was treated, in classification, as the retrieval of information, and its impact on the outcome was handled in the same manner as for so-called "effective" searches. In some other "ineffective" instances, some useful citations were retrieved and had a beneficial effect, even though the search did not accomplish everything the user wanted. In such cases, also, the incident was treated in the same manner as effective incidents with similar impact.

**Respondent and search characteristics.** A second type of analysis consisted of straightforward tabulations and cross-tabulations of the information recorded on the back of each incident form--information concerning the search and information concerning the interviewee. Data concerning respondent characteristics were examined separately for the end user (AIR), mediated user-UTexas, and mediated user-UCLA-community samples. Data concerning characteristics of the searches were examined separately for searches conducted by the respondent personally (end user searches) and those done by an intermediary, typically a medical librarian (mediated searches). It should be noted that a few "end users" reported on searches done for them by an intermediary and, conversely, a few "mediated users" reported on searches they had carried out themselves.

**Verification.** A third type of analysis was aimed at verification of the data collection process and the incident reports. This had two components: (1) transcription of tapes of a small proportion of the interviews and comparison of the transcripts with the incident reports (described above), and (2) comparison of the MEDLINE transaction logs with the incident reports for incidents occurring within a time window where this was possible.

The comparison of incident reports with transaction logs required advance permission from the respondent to examine their logs, permission which was requested in the initial letter and was forthcoming in all cases. The AIR ID codes for persons interviewed at the end of a given time period (three-week intervals for Round 1 and two-week intervals for Round 2) were provided to NLM where they were matched to NLM access codes, and NLM traffic files reflecting search activity for each of the access users over the preceding 15-week period were retrieved. Fifteen weeks is the usual time period for which traffic files are retained at NLM. All search activity during the time window for each user was identified, and an attempt was made by NLM staff to match each incident report with a corresponding search recorded in the traffic log. The transaction logs that were exact or possible matches for incident reports were forwarded to AIR for further analysis.

Of the 704 end user searches examined (among the total of 762), 304 occurred outside the time window for which transaction logs were available. Of the remaining 400 incidents, 188 (47%) were matched by NLM staff to a corresponding search in the transaction log; 185 (46%) were not matched to a corresponding search; and 27 (7%) could not be matched precisely due to ambiguity in the incident report (e.g., an author search, but with no specific name provided). Of the 185 non-matched incidents, 75 (41%) were reported to have occurred within the previous three months, but may in fact have taken place somewhat earlier, outside the time window for the available transaction logs; 12% were carried out on a system other than NLM's; and 29 (15%) were not matched due to a variety of clerical, processing and recording reasons. Sixty of the incidents (32%) occurred well within the time window, and the failure to match remains unexplained. Possible explanations, other than inaccurate recollection of the substance of the search
incident, include the possibility that the search may in fact have occurred on a non-NLM system, that the respondent may have done the search under a different access code, or that some of the transaction log data were missing.

A sample of 135 of the matched incident reports and corresponding transaction logs were compared by a professional librarian on a number of objective features of the search in order to determine the relationship between the features as reported by the respondent and those reflected in the log. The features examined included the following: use of MeSH headings, textwords, Boolean operators, and search qualifiers (English only, reviews only, backfiles and time periods, humans only); and whether the search was carried out iteratively. In addition, a more subjective judgment was made by the librarian during the comparisons as to whether the incident report was an exact or essentially accurate description of the search that occurred, whether there were some differences but the report was accurate in all important respects affecting its interpretation for the present purpose, or whether there were differences significant enough to cast doubt on the match or the validity and usefulness of the incident report.

Analysis of reports and logs of ineffective searches. The analysis of ineffective searches was carried one step further. For 135 such searches, matched or possibly matched transaction logs were located. Two professional librarians reviewed each incident report. In the verification process 10 logs were determined not to be matches. The analysis of the remaining 125 concentrated on what the respondent said he/she was looking for, how the respondent recalled the search having been carried out, and the results obtained. The librarian analysts then conducted their own MEDLINE search aimed at getting the desired information and compared the new results with those reported by the respondent. For each such comparison a conclusion was drawn as to whether the respondent had obtained essentially all of the available citations, i.e., whether the search had been conducted properly even if the results had been ineffective in the sense of not meeting the respondent's needs. If the respondent's search had not obtained all the available citations, the analysts went on to determine what it was about the searcher's strategy or the execution of the search that had caused it to fail to locate available and apparently relevant citations. These search-by-search judgments were then summarized across searches in order to identify common search problems.
RESULTS

CHARACTERISTICS OF RESPONDENTS AND SEARCHES

Overview of the data

For the 552 interviewees, 471 interviews were conducted from the AIR or NLM offices by AIR staff (including 110 from the sample supplied by UCLA Regional Medical Library), and 81 interviews were done at the University of Texas. The interviews resulted in a total of 1,158 incidents, 1,019 obtained by AIR (including 228 from the UCLA sample) and 139 by UTexas. Seven (7) of the 552 interviewees did not provide any usable incidents and are not included in the subsequent tabulations, which are based on the remaining 545 interviewees who provided at least one usable incident. The percentages of usable respondents from the three sources (NLM, UCLA, and UTexas) are given in Table 1, which also indicates the percentage interviewed from the various interview sites (the NLM offices, the AIR office, and the University of Texas RML).

Table 1. Location of Interviewer and Type of MEDLINE User, by Source of Sample

<table>
<thead>
<tr>
<th>Source of Sample</th>
<th>Location of Interviewer</th>
<th>NLM Records</th>
<th>UCLA Records</th>
<th>UTexas Records</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NLM Offices</td>
<td>38</td>
<td>0</td>
<td>0</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>AIR Offices</td>
<td>316</td>
<td>110</td>
<td>0</td>
<td>426</td>
</tr>
<tr>
<td></td>
<td>UTexas RML</td>
<td>0</td>
<td>0</td>
<td>81</td>
<td>81</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>354</td>
<td>110</td>
<td>81</td>
<td>545</td>
</tr>
</tbody>
</table>

| Type of User     | End User                 | 753         | 4            | 5              | 762   |
|                  | Mediated User            | 38          | 224          | 134            | 396   |
|                  | Total                    | 791         | 228          | 139            | 1158  |

Although the three sources were selected because they could yield samples of individuals identified as end users or as having requested mediated searches, in fact a very small proportion (about 2-5%) of the searches reported by persons from each sample were carried out by the opposite mode (see Table 1). Thus, the AIR-NLM respondents reported on 753 end user searches and 38 mediated searches; the UCLA sample reported on 224 mediated searches and 4 end user searches; and the UTexas respondents contributed reports on 134 mediated and 5 end user searches, resulting in a total of 762 end user searches (66% of the total) and 396 mediated searches (34%).
Table 2 indicates how much time passed between the search and the interview and the numbers of searches reported that were judged to have been effective or ineffective in fulfilling the respondent's need for information. Approximately 30% of the searches had occurred within the month preceding the individual's interview, another 40% within the preceding 2-6 months, and 30% more than six months prior to the interview. Out of the total of 1,158 incidents, 991 (86%) concerned searches that the respondents considered to have been effective in terms of their impact on the respondent's professional activities, and 167 (14%) were reports of searches considered to be ineffective—about the same proportions for both end user and mediated searches. However, these proportions of effective and ineffective searches, in total and among the two kinds of users, do not provide unbiased estimates of the proportions of such searches that occur.

Table 2. Recency and Results of Searches Reported by End Users and Mediated Users

<table>
<thead>
<tr>
<th>How Long Ago Search Occurred</th>
<th>End Users</th>
<th>Mediated Users</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Within past week</td>
<td>86</td>
<td>11</td>
<td>16</td>
</tr>
<tr>
<td>Within past month (&gt;1wk)</td>
<td>183</td>
<td>24</td>
<td>62</td>
</tr>
<tr>
<td>Within past 3 months (&gt;1mo)</td>
<td>136</td>
<td>18</td>
<td>103</td>
</tr>
<tr>
<td>Within past 6 months (&gt;3mo)</td>
<td>145</td>
<td>19</td>
<td>80</td>
</tr>
<tr>
<td>Within past year (&gt;6 mos)</td>
<td>122</td>
<td>16</td>
<td>70</td>
</tr>
<tr>
<td>More than 1 year ago</td>
<td>89</td>
<td>12</td>
<td>65</td>
</tr>
<tr>
<td>Total</td>
<td>761</td>
<td>66</td>
<td>396</td>
</tr>
</tbody>
</table>

Results of Search

<table>
<thead>
<tr>
<th></th>
<th>End Users</th>
<th>Mediated Users</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective</td>
<td>648</td>
<td>343</td>
<td>991</td>
</tr>
<tr>
<td>Ineffective</td>
<td>114</td>
<td>53</td>
<td>167</td>
</tr>
<tr>
<td>Total</td>
<td>762</td>
<td>396</td>
<td>1158</td>
</tr>
</tbody>
</table>

*Missing data: N=1

The following sections describe the characteristics of the 545 individuals who provided reports on their MEDLINE searches, as well as the characteristics of the searches. Detailed tabulations of this information can be found in Appendix D.

Respondent characteristics

MEDLINE experience. The vast majority of the respondents (91%) are individuals who have been doing/requesting their own MEDLINE searches for more
than one year, and the percentages are approximately the same for both the end user and mediated user samples. The respondents also have had a significant amount of experience with searches—approximately 80% have done/requested more than 10 searches (86% for end users, but only 69% for mediated users); approximately 62% have done more than 20 searches (68% and 50% in the two groups, respectively), and 34% have done more than 50. Further, the end users search relatively frequently—80% of the end user sample, but only 37% of the mediated users, said they do one or more searches per month; 30% of the end users said they search on a weekly or more frequent basis (i.e., that they do four or more searches per month).

The end users learned to search MEDLINE through a variety of means. Forty-one percent (41%) are self-taught and 6% were taught by friends. Forty-one percent (41%) took either the NLM 3-5 day course (14%) or the NLM 6 hour class (27%), including a few of those who began on their own or with the help of a friend and later got some formal training. It also is reasonable to assume that the 23% who received some "other" formal training generally received an NLM-designed or derived program, but given under the sponsorship of a medical library so that its origin was not apparent to the respondent. Hence it appears that over 60% of the end users have received some form of formal training on MEDLINE. However, only 3% reported that they had received formal instruction on Grateful Med.

**Profession and location.** Sixty-six percent (66%) of the respondents have an M.D. degree and an additional 5% have both an M.D. and Ph.D., for a total of 71% with medical degrees. An additional fourteen percent (14%) have a Ph.D. degree only, and 1% a D.D.S., bringing the total number with non-medical doctorates to 20%.

In terms of professional activities, 77% spend at least some portion of their time (an average of 60%) on patient care activities; 65% are involved in teaching (averaging 21% time); 59% are involved in research (averaging 40% of their time); 53% have some administrative responsibilities (averaging 23% time); and approximately 8% are involved in some other professional activity (typically consulting work, on which they average 46% time). The largest proportion of the sample (39%) are persons who are employed most of their time (an average of 80%) in a medical school. Thirty-five percent (35%) work at least part time in a hospital (those who do so average 77% time in this setting). Approximately 28% spend at least some of their time in either a solo or a group practice, and those who do so tend to work the majority of their time (over 87%) in that setting. Relatively small percentages are employed in an HMO setting (4%), by a government agency (5%), or do private consulting (1%), and the majority of the latter divide their time about equally between consulting and their other professional activities. Approximately 10% spend the majority of their time (an average of 89%) in some "other" setting, including industry.

The differences among the professional activities of the NLM, UCLA, and UTexas samples are also apparent that undoubtedly affect the mixture of search reports contributed by these three groups. The UTexas sample has high percentages of individuals reporting at least some time spent on all four of the major types of professional activities—patient care, research, teaching and administration. This mixture suggests that most individuals are involved in several of these activities, consistent with the fact that a high percentage work in the UTexas Medical Center. It is also indicated by the fact that, for those who spend any time on a given activity, the percentage of time spent is somewhat lower for the UTexas sample than for the NLM sample; in other words, their time is distributed among a number of different
professional activities, as one would expect in an academic medical center. Similarly, it appears that their employment is more likely to be divided among two or more work settings.

The UCLA sample is also distinct from the other two. It was intended to be a sample of community physicians and, as would be expected, only about one-third spend any time conducting research. Those who do so only spend about 12% of their time in that activity. These individuals also spend more time on patient care and administrative activities than individuals in the other two samples. This difference is further indicated by the difference in their work setting. Nearly all are involved in primary patient care in either a private, HMO, or hospital practice; less than 4% of this group spend any time working at a medical school.

All of those in the UTexas sample report that they work in a large metropolitan area. Over half (52%) of the NLM and UCLA interviewees also are located in a metropolitan area of 1 million or more population, with another 20-25% in areas between 250,000 and 1 million population. Only 8% of the sample are located in cities under 50,000 population.

Searches

Stimulus for search. Approximately 45% of the searches reported were done in response to information needs that arose in connection with patient care. Sixteen percent (16%) arose in connection with teaching, 24% in relation to research issues, and 15% were occasioned by "other" reasons. Incidents were obtained in all categories from all three groups -- end users and the UCLA and UTexas mediated users -- but the proportions differ. A higher proportion of the mediated searches from UCLA concern patient care, as would be expected from a sample of community physicians; a higher proportion from UTexas concerned research, which would be expected from physicians working in an academic medical center.

Of the 515 searches that occurred in the context of patient care, 56% concerned the physician's own patient, 28% another physician's patient, and 16% concerned a type of patient problem rather than an individual patient. Thirty-three percent (33%) of the questions motivating the searches arose in the course of care being delivered in the physician's own office; 48% in the course of hospital inpatient care; 11%, hospital outpatient care; 2% care in the ER; and 6% care being given in another setting.

Of the 193 searches that were occasioned by teaching issues, 43% were related to some type of instructional writing (textbook, etc.), 19% to an educational presentation (e.g., a case or clinical conference), 17% to continuing education, 12% to graduate medical education, 9% to some other type of teaching, and only 1% to undergraduate medical education. The majority of the searches occasioned by research related to research in progress (37%), and another 24% to research planning or to the preparation of a research paper (23%). Nine percent (9%) were related to the preparation of a grant application. The remainder of the search reports arose from other issues--35% of these from administrative issues, 25% were done for the purpose of personal learning, 16% from non-patient care consulting issues, and the remaining 23% for various other reasons.
Location of search. Slightly over half of the end user searches (51%) were performed from the physician's office and most of the remainder were done from their homes (41%). The mediated searches were virtually all carried out in a hospital or medical school library (59% and 38%, respectively). Virtually all of the mediated searches (94%) were performed by medical librarians.

Search parameters. For the end user searches described in the interviews, 79% were said to have used MeSH headings, 75% to have used Boolean operators, and 47% to have used qualifiers to restrict the search in some manner. Fifty-two percent (52%) indicated that the search was iterative, i.e., that the search was modified and rerun at least once on the basis of the initial results. In general, those who requested mediated searches did not know the details of how the search was carried out.

Abstracts were obtained for 62% of the searches (end user and mediated combined), and appear to have provided sufficient information for the searcher's purpose in approximately one-third (31%) of the instances in which they were requested. In 79% of the searches the individual obtained at least one of the articles cited (88% in the case of the mediated searches). Of those who did not obtain any of the articles, 33% indicated that this was because none of the articles looked useful, and another 32% said the abstracts provided enough information. Only a small percentage said it would have been too difficult to get the articles (3%), that they had no time to do so (11%), or that they didn't need to do so (3%); the remainder gave some other reason (18%).

Use of Grateful Med. Slightly more than half (54%) of the end user searches were carried out using Grateful Med, and the vast majority of these Grateful Med searches were done using the form screens or menus. Thirty-nine percent (39%) of the end user searches were done by direct access using command language. Another 6% were done using other access systems. Combining the numbers done using command language via Grateful Med and the numbers done by accessing directly indicates that a total of 44% of the end user searches were carried out using command language.

Somewhat fewer than half of the searches were done by the same means the searcher had always used; for the others, the searcher had prior experience with some other means of conducting a MEDLINE search. Many had had mediated searches performed for them, but others, who were using direct access for the search in question, had used Grateful Med before, either command language (25%) or the Grateful Med form screens (6%). And conversely, many who were using Grateful Med form screens had done previous searches using command language, either directly (43%) or via Grateful Med (3%). Given the timing of this study, it is not surprising that most of those using Grateful Med reported searches carried out using version 3, released January 1988 (60%), while the majority of the remainder reported using version 4 (released December 1988) or 2 (released March 1987). The rest either reported using version 1 or could not recall which version was used.

Mediated search requests. Those who requested mediated searches had typically communicated their request to the searcher by direct discussion (77%) or some other means (14%), rather than by some type of written search request form. And in almost all cases (93%), they were not present when the search was performed.
RESPONDENT COMMENTS CONCERNING NLM SERVICES

All general comments interviewees made regarding MEDLINE, Grateful Med, or any other issues relevant to NLM services were carefully recorded. The comments were organized and transmitted in their entirety to NLM. They cover the following topics: general praise/criticism and comments on the impact of MEDLINE searching on their professional life; specific user issues such as desirable or problematic features of the system and the search process—utility of abstracts, assessing the articles and ordering copies of articles, index terms and MeSH headings, backfiles, retrieval format/printing, hardware/software, access to ELHILL computer, command language, information coverage; reasons for using (or not using) an online search service; who carries out the search and why; Grateful Med documentation and updates; assistance with problems; alternative programs for accessing or managing MEDLINE data; as well as comments on costs and billing. A few comments were also made regarding the interview questions themselves and potential uses of the data. Many of the comments reiterate input already available to NLM (e.g., the interest in having a Macintosh version of Grateful Med), but others appear to be new and of value in either directly suggesting a new feature or, indirectly, in revealing problems/misunderstandings that could be addressed by new features, new educational materials, or better documentation.
THE INCIDENT REPORTS

Examples of incident reports

Figures 1 and 2 contain five examples of complete incident reports—the raw data from which the three taxonomies were constructed. They also illustrate the data on which the case study abstracts are based. These abstracts have been prepared for potential dissemination to professionals and the public. Examples of case study abstracts for these particular incidents are contained in Appendix E.

Verification of parameters of the end user searches

The 125 end user incident reports that were matched to transaction logs enabled verification of certain parameters of the searches reported by respondents. Of 105 instances in which the respondent claimed that MeSH headings were used, this was confirmed in the transaction logs 90% of the time; of the 19 reports that MeSH headings were not used, 84% were confirmed. Some cases were found in which the searcher used a MeSH heading (and reported using one) but did not specify the term as such in the actual search specifications, thus receiving postings as both a MeSH heading and a textword. These instances were counted as confirmed by the log. The data from the logs indicate that 78% of the searches actually used MeSH headings, which is slightly lower than the 85% claimed for this sample of (matched) incidents.

In virtually all of the instances where respondents claimed to have used Boolean operators (98 incidents) this was confirmed by examination of the transaction logs (99% verification). However, of the 22 cases in which the respondent indicated that such operators were not used, only 32% were confirmed. This means that such operators were actually used in 93% of the searches in this sample, compared with the reported 82%, and suggests that the reported rate for all the end user reports (75%) may be a considerable underestimate. For Grateful Med users, this may be partially explained by the fact that Boolean operators are generated automatically, of which some users may be unaware.

In 74 instances the respondent indicated that the search was "iterative," which was intended to mean that search results were obtained and the search revised and rerun in order to refine/improve the results. The logs confirmed this in 89% of these cases. However, there is an indication that the term "iterative" may have been interpreted too restrictively by respondents in that for the 50 cases in which respondents reported that the search was not iterative, the logs confirmed this only 50% of the time. In other words, about 73% of the searches were iterative, by our definition, regardless of the respondent's claim. If the respondent data were accepted for this sample (or for the total set of end user incidents), it would have been concluded that only about 60% (or 52%) of the searches were iterative.

The respondents indicated that 51% of the matched searches used qualifiers (which was defined for them as meaning a restriction of the search to English articles only, humans only, reviews only, or specific backfiles). The logs verified this 71% of the time. Among the 49% said not to have used qualifiers, the logs confirmed this 82% of the time. Overall the reported and observed proportions of searches using qualifiers were similar—51% and 45%, respectively. Among all 643 end user searches for which this information is available (the question was not asked in the pretest), the respondent reports indicated 46% used qualifiers.
With respect to specific qualifiers, in 16 instances the respondents specifically mentioned they restricted the search to reviews, and this was verified 88% of the time. Seventy reports mentioned searching backfiles and gave specific periods used. The logs only bore out the fact that backfiles were searched in 59% of the cases, meaning that there is considerable inaccuracy in the reports in this regard. Verification was 91%, however, in the eleven cases in which respondents claimed they only used the current file. And, where the search was said to have been restricted to English articles (42 instances), this was generally borne out by the logs (98%). Only one search was said not to have been restricted, but the log contradicted this. The number of searches said to be limited to humans (5) was small, but it would appear that this is not accurate—none of these searches were thus limited. While the respondent may only have been interested in material on humans, in fact the search was not limited in this way.

Abstracts were reported to have been requested in 62% of all the searches; among end user searches, abstracts were said to have been requested 68% of the time. The log analysis revealed that abstracts really were requested for approximately 57% of the end user searches. The claim that abstracts were requested was confirmed 84% of the time; that they were not, 85%. Thus this parameter of the search appears to have been fairly accurately reported.

In addition to evaluating the correspondence of logs and search reports on a parameter-by-parameter basis, a judgment was made for each incident as to whether the search as reported was "very close" or just "close" to the search as revealed by the log. In 72% of the reports in this sample, the correspondence was judged to be very close; in 28% to be close.

These results, as well as the even more detailed analysis of the logs for ineffective searches, suggest that the segments of the reports describing how the search was carried out are generally useful for the present purpose. The results provide some indirect reassurance that other aspects of incident reports, such as the motivation behind the search and its value to the respondent, are also reasonably accurate. And it could be argued that the latter aspects, being more pertinent to the respondent, are likely to be recalled with greater accuracy than are the details of the search.

The verification results do indicate a need for considerable caution in interpreting the reports where this concerns certain specific features of searches, particularly where Boolean operators were said not to have been used or the search was said not to have been iterative. And the specific time periods said to have been included in searches of backfiles clearly are not reliable.
Figure 1. Examples of Reports of Effective MEDLINE Searches

Incident # U07402: Effective Incident Report Form — Mediated User

What was the situation that led to your need for this search? I've done psychotherapy with several high-functioning autistic children who had good language and learning skills but with a layer of depression that was significant to the extent of becoming suicidal. A psychiatrist told me about a new syndrome he'd just heard about called Asperger's syndrome that seemed to describe these sorts of children.

What specific information were you seeking? I wanted to know more about Asperger's syndrome. What is it?

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? The doctor who'd mentioned it to me didn't know anything more about it, and he's my best local source. MEDLINE was the next place to look.

How did you explain your information need to the person carrying out the search? I gave her the name of the syndrome and told her it's a form of high-functioning autism.

How was this search carried out to get the information you needed? I don't know how she carried out the search, but she said she could search under the direct name of the syndrome.

What information did you obtain as a result of this search? There's been research on it both in Australia and England, and there's controversy about whether it really exists. The Australians described it first. They feel that you can do a urine test to look for a protein deficiency to identify it; the English say that it's just a checklist of behavioral symptoms. But there is agreement that there is a cyclic depression overlaying some cases of autism and that it tends to run in families.

In what specific ways was this information helpful in your decision making? It was helpful to have verification that there is depression in autistic children. The review board here at the hospital has tended to declare that autistic children are not cognitively able to be depressed. By showing them the articles I've been able to convince them that it did exist, even though the research was too new to know whether it's a behavioral or physical manifestation.

What was the impact on the situation of having this information? I was able to get more psychotherapeutic treatment for autistic, depressed children, once the board was convinced they could benefit from it.

What was the outcome of the situation? Now I can put autism and depression on a child's DSM form and know the child will get more care. Also, it helps the children when we explain to families and teachers that this is a dual disability—that they have to combine the structure needed by an autistic child with the supportiveness that a depressed child needs. It helps me to consult with teachers and families about when to back off.
Incident # 074503: Effective Incident Report Form — End User

What was the situation that led you to do this search? There was a question raised in AIDS clinic about what the utility of beta-2 microglobulin was for assessing the activity of HIV infection. I wanted to research this topic to prepare a presentation to the AIDS clinic staff. We had heard about the beta-2 microglobulin test, but no one in our group was familiar enough with it to understand how useful it might be, or how to interpret it, for evaluating the condition of patients with AIDS. We were trying to decide if we should be doing this test here.

What specific information were you seeking? Information on use of the beta-2 microglobulin test for evaluating the condition of AIDS patients.

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? In the AIDS field, by the time something is published it's old hat, and by the time it's in textbooks it's ancient history. We wanted very current information.

How did you carry out this search to get the information you needed? I went through Grateful Med. I used "beta-2 microglobulin," but it was not a MeSH word. I may have used it as a title word. I joined this with AND to "AIDS." I searched back 2-3 years, and ran it several times. No limiters were used.

What information did you obtain as a result of this search? Beta-2 microglobulin is shed by cells that are turning over or dying. So the test is an index of disease activity. It's an index of white blood cell turnover. Therefore, elevated beta-2 microglobulin is also an indicator of other diseases besides AIDS.

In what specific ways was this information helpful in your decision making? The test would be of some use for AIDS patients. It would give an idea of how rapidly lymphocytes are being destroyed, by HIV or anything else. It's not specific for HIV.

What was the impact on the situation of having this information? I provided this information to the AIDS clinic.

What was the outcome of the situation? We decided not to use the test. We don't think it's worth the high cost. But the information I got allows us to interpret the test results, for example, if someone else orders it.
Incident # T00801: Effective Incident Report Form — Mediated User

What was the situation that led to your need for this search? We had a patient with giant cell tumor of the metatarsal bones of the feet. The doctor [the interviewee is the physician assistant of the doctor who works with him on the cases and does his bibliographic research] had removed the tumor in the past. The patient had been treated several years in the past and now had returned with several more tumors.

The doctor got a second opinion which included removing the foot or just removing the tumors by osteotomy. The doctor wanted to find out in what cases amputation would be indicated.

What specific information were you seeking? I was looking for giant cell tumor of the foot, especially indications for amputation.

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? We did look at orthopedic journals and books; but this topic also comes under the oncology field. It is also convenient for us to call and get a MEDLINE search.

How did you explain your information need to the person carrying out the search? I called and told him I wanted a search for the past 5-10 years on metatarsal, giant cell tumors; actually we looked for giant cell tumor anywhere as it is usually of the extremities and we also wanted to look at any metastasis.

How was this search carried out to get the information you needed? I am not familiar with the term MeSH. They did use "AND," "OR." I said I am only interested in English. The search was run once.

What information did you obtain as a result of this search? The articles indicated amputation was only necessary if biopsy showed that there were malignant changes in the tumors and that metastasis was likely. They gave the reason for doing an osteotomy instead of amputation.

In what specific ways was this information helpful in your decision making? The information helped save the patient's foot. The doctor decided to do an osteotomy and biopsy rather than amputation.

What was the impact on the situation of having this information? The doctor decided to do an osteotomy (remove the tumor and bone). The lady would have lost her foot otherwise. Osteotomy was performed; the biopsy was negative, so we saved the lady's foot.

What was the outcome of the situation? The lady is doing very well.
Incident # 046602: Effective Incident Report Form — End User

What was the situation that led you to do this search? We were interested in the sequence of the genes of ovalbumin — chicken egg white. We wanted to transform plants to produce ovalbumin. This was a research project in our laboratory.

What specific information were you seeking? We were looking for the gene sequence. It had been known for awhile but we needed to know where it was published.

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? Its convenience.

How did you carry out this search to get the information you needed? Text: ovalbumin AND sequence OR gene. I also searched by author’s name.

What information did you obtain as a result of this search? I found a series of papers we weren’t aware of which contained the properties and sequence of the ovalbumin gene and techniques for isolation and utilization.

In what specific ways was this information helpful in your decision making? It allowed us to devise a research project where we could clone the gene into a plasmid and transform plants to increase their nutritional value.

What was the impact on the situation of having this information? We were funded for the next three years to pursue studies. Without this information we would not have been funded.

What was the outcome of the situation? We have transformed plants to produce ovalbumin. We reported at the AAAS meeting recently. We used carrots, potatoes, petunias. Ultimate goal: these more nutritious plants may become commercially available.
Figure 2. Example of Reports of Ineffective MEDLINE Searches

Incident # 044301: Ineffective Incident Report Form — End User

What was the situation that led you to do this search? I was writing an article on chest wall recurrences. There was a lot of literature on that area. These are recurrences of breast carcinoma in patients who had adjuvant chemotherapy but no radiation until the recurrence had occurred.

What specific information were you seeking? Studies in women after mastectomy who had adjuvant chemotherapy and later had a recurrence in the breast wall with no other evidence of cancer. They were only to have had radiation at time of recurrence.

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? I consulted everything. MEDLINE was the best.

How did you carry out this search to get the information you needed? I used MeSH — breast neoplasm and chest wall recurrence. I did also by text words — mastectomy. I went all the way back. I did several searches.

What information did you obtain as a result of this search? There were only 4 articles written on this type of thing. Mostly reassurance that I didn't miss important information from journals I hadn't read.

In what way was the search or its results unsatisfactory? It was difficult to get across to the computer the timing of the disease. I had too broad an area. I wanted a photograph of these patients. Patients will live 15 years after mastectomy with many different types of surgery and therapy. It was hard to eliminate these other sequences from my search result.

What search results would have been more helpful in your decision-making? If I could have sequenced different modalities. I wish I could have done it more quickly and concisely.

What was the impact on the situation of not having the information? If I would have missed one of the articles it would have looked bad, especially if the author of one of the 4 articles would have been a reviewer; I might not have gotten the paper published.

What was the outcome of the situation? I did write and publish the paper. My advice to people has changed, mostly as function of my study. Nationally we are getting away from post-op radiation, and now give surgery and chemotherapy. There is an enormous incidence of chest wall recurrence — as high as 40% recurrence in large primary tumors, positive axillary nodes. I now recommend radiation in these patients.
TAXONOMY: WHY INFORMATION WAS NEEDED FROM MEDLINE

The analysis of the incident reports resulted in a detailed enumeration of the reasons respondents gave for needing information from MEDLINE. These reasons were organized into the taxonomy or outline shown in Figure 3. Brief statements that illustrate the kinds of incident reports that make up each of the categories in Figure 3 can be found in Appendix F. The numbers of incident reports classified in each category are given in parentheses following the category heading in the appendix.

The major areas that generated a need for information from the biomedical literature via MEDLINE were the following: I. Patient care (43% of the reports); II. Research (20%); III. Teaching (20%); IV. Learning (7%); V. Administration (6%); and VI. Other (3%). These areas correspond to the typical divisions of physicians' professional activities (patient care, research, teaching, administration, etc.), and the decision to use these major groupings deserves comment. It was not simply assumed that this would be the most useful approach. Rather, it became clear, as dissimilar incidents were separated and nearly identical ones grouped together, that putting patient care and research incidents together was not natural and required the imposition of some theoretical framework or set of constructs regarding mental processes and information processing at a more abstract level. For example, creating a category such as that "the information was needed in order to confirm an existing hypothesis," but disregarding whether the hypothesis related to patient care or research, tended to obscure what appeared to be very useful distinctions. At some point, such an analysis may prove useful, and the incidents certainly can be reconsidered from that perspective. However, at present, it appears that there are sufficiently different needs with respect to patient care, research, teaching, and other professional activities that it is most useful to treat them separately.

The following is a description of the information needs that are displayed in Figure 3.

I. Patient care

The information needs of physicians with respect to patient care group fairly naturally into needs related to the following areas: A. Diagnosis and etiology (41% of the patient care reports); B. Treatment and prognosis (51%); C. Maintaining an effective physician-patient relationship (4%); D. Disease prevention (3%); and E. Discharging responsibilities to third-party payors (1%).

A. Diagnosis and etiology

Two types of information needs were identified in the incident reports that relate to determining the nature and cause of medical problems -- their diagnosis and etiology. The first concerns the use of diagnostic test and procedures; the second the process of establishing a differential diagnosis.

Not surprisingly, the information needed on diagnostic tests and procedures usually concerns the application or interpretation of new or relatively infrequently used tests. The incidents included reports of situations in which a physician needed information that would help select the appropriate test to provide a definitive diagnosis of a condition or that would help differentiate between two conditions or
variants of a given problem (e.g. hereditary and non-hereditary forms of a disease). Reports were also obtained of instances in which a physician needed information that would help ensure that a test, often a relatively new test, was applied correctly. In other cases, the need was for specific data on the sensitivity or specificity of a particular test, either to determine whether it should be used or to help determine the implications of the results. Finally, there were reports of instances in which, in order to interpret the results of a test appropriately, the physician needed information that would indicate whether the results were within normal limits for a patient of a particular age, sex, etc. or needed to better understand how particular results (e.g. MRI findings) were related to particular diagnoses.

There were many other reports in which information was sought from MEDLINE in order to assist in the establishment of a differential diagnosis. Two principal types of situations were identified -- situations in which a physician was faced with a patient with new symptoms and needed information in order to reach a diagnostic conclusion and situations in which a patient under treatment for some problem developed new or additional symptoms. In the first type of situation, there were instances in which the physician was quite puzzled and needed to identify the possible diagnoses or etiology. In other reports, information was needed that would tend to support or rule out a particular diagnostic hypothesis or in order to help differentiate between two possible diagnoses. In yet other instances, the physician had already ruled out the most common diagnosis of the patient's symptoms and wanted to identify or evaluate other possibilities, or had reached a tentative conclusion but was faced with some symptoms or findings that were inconsistent with and presentations of the disease with which he/she was familiar. The need was for information that would indicate whether such a pattern had been observed and would indicate how it could arise from the condition in question.

In situations where a physician was caring for a patient and new or additional symptoms developed, there were instances in which there was a need to determine whether these symptoms were related to the patient's existing medical problem or not and to determine whether two conditions arising at the same time had ever been observed to be associated and due to a common cause. The occurrence of new symptoms also opens up the possibility that the symptoms have an iatrogenic cause, and are either a medication side effect or are due to some other (non-medication) aspect of the treatment being given to the patient.

B. Treatment and prognosis

A wide variety of different information needs were identified relating to the choice and implementation of medical treatment. In such instances, the diagnosis had been made, but some aspect of the treatment plan or prognosis was unclear. For example, the physician might be confronted with a situation in which it was unclear whether there were any treatment options available, and the need was for information that might reveal the existing possibilities. The physician might be considering a particular approach and want information to help support this choice. Alternatively, the physician's colleagues might be arguing for one approach and the physician for another, and the need the physician felt was for information that would indicate the relative merits of the alternative approaches and potentially reject the approach proposed by his/her colleagues. A similar situation was reported in which the physician was considering two alternatives and wanted information that would shed light on their relative merits.
Figure 3. Reasons Why the Individual Needed Information from MEDLINE

I. Patient care:

A. Diagnosis and etiology
   1. To utilize diagnostic tests and procedures
      a. To help select an appropriate test(s) to diagnose some condition or establish a differential diagnosis
      b. To help apply a (new) diagnostic procedure correctly
      c. To evaluate test sensitivity/specificity
      d. To help interpret test/diagnostic procedure results correctly
         (1) To determine whether test/procedure results were within normal limits
         (2) To better understand relationship of test/procedure results to particular diagnoses
   2. To establish a differential diagnosis
      a. To help establish diagnosis for presenting symptoms
         (1) To suggest a possible diagnosis and etiology
         (2) To obtain evidence to support/disprove a hypothesized diagnosis
         (3) To differentiate between two hypothesized diagnoses or disease variants
         (4) To identify or evaluate possible alternative diagnoses when most common diagnosis has been ruled out or is doubtful
         (5) To help interpret symptoms or physical findings which appear inconsistent with probable diagnosis
         (6) To determine or better understand the cause of a diagnosed condition
      b. To diagnose cause of new symptom(s)/change of condition in patient(s) under treatment
         (1) To obtain evidence to support/disprove hypothesis that new/additional symptoms are part of known/preexisting medical problem
         (2) To obtain evidence to support/disprove hypothesis that observed symptoms are due to a medication side effect
         (3) To suggest other (non-drug related) iatrogenic causes that might underlie observed problem
         (4) To determine whether two conditions previously had been observed to be associated and due to a common cause

B. Treatment and prognosis
   1. To obtain general information to support choice of treatment and determine prognosis for a presenting condition
      a. To identify any treatment options for a known condition
      b. To obtain evidence to support/reject use of given treatment option
      c. To evaluate the relative merits of two drugs or procedures for a particular medical problem
      d. To evaluate a treatment prescribed by a prior or referring physician
      e. To determine the necessity/advisability of surgery versus observation/medical treatment for a particular condition
      f. To determine the need for treatment (e.g. radiation or chemotherapy) in addition to surgery
g. To determine what is the appropriate treatment in the presence of a second disease/condition in the patient

2. To obtain information on the clinical course and general management of a relatively rare disease/condition
   a. To determine the course and general management of a condition unfamiliar to practitioner
   b. To determine the clinical course, prognosis, and general management of a specific neoplasm
   c. To determine the potential impact of pregnancy on preexisting medical problem

3. To obtain information on the impact of a medical problem on the management of another condition or problem
   a. To determine impact of condition and/or its treatment on general management of primary care
   b. To determine impact of condition and/or its treatment on pregnancy and appropriate management during pregnancy and delivery
   c. To determine implications of condition or its treatment for anesthesia management
   d. To determine impact of condition and/or its treatment on the potential outcome of surgery

4. To obtain information on the proper use of one or more specific treatment options known to the physician for a specific condition
   a. To determine whether there were any known guidelines for applying treatment in an unusual situation
   b. To identify information that could prevent procedural mishaps
   c. To evaluate potential side effects of a treatment
   d. To obtain information on possible new uses of a known treatment

5. To obtain information on new or alternative treatments for a specific condition
   a. To evaluate a promising new treatment or variation not readily available in the U.S.
   b. To obtain information on a treatment with which physician is not familiar
      (1) To determine if treatment is appropriate alternative for specific patient
      (2) To determine if treatment would be of use to future patients
   c. To evaluate possible alternative treatments when the standard treatments are not working or are causing unacceptable side effects

6. To obtain information on monitoring procedures and techniques

7. To obtain prognostic information

8. To locate specialist for referral

C. Maintain an effective physician-patient relationship
   1. To provide information to patient so he/she could make informed choices
   2. To advise patient(s) considering participation in a clinical trial
   3. To advise a friend, colleague, or family member on a disease, condition, or treatment outside the physician's specialty

D. Prevent disease
   1. To obtain information on health maintenance and primary prevention strategies and resources
   2. To obtain information pertinent to evaluating life style or environmental risk factors
3. To obtain information to improve effect of hospital environment on patient

E. Discharge responsibilities to patients and third-party payors
   1. To identify information to support or deny reimbursement for treatment or procedure by insurance carrier
   2. To determine whether patient is entitled to benefits

II. Research

A. Research planning and execution
   1. To determine whether a research area is viable
      a. To determine whether an important problem, knowledge gap, or controversy exists
      b. To determine whether a proposed study has already been done
      c. To determine whether any evidence exists that would support the validity of a given hypothesis or feasibility of an approach
   2. To determine the specific target for a research study so as to be the most productive
   3. To help formulate specific research questions
   4. To choose (more) appropriate variables/factors/conditions for use in research design
      a. To identify (more) appropriate variables to be manipulated in an experiment
      b. To identify (more) appropriate factors to be tested in an experiment
      c. To identify (more) appropriate variables or measures to use in epidemiologic research
   5. To choose or effectively implement an appropriate methodology
      a. To identify an appropriate protocol
      b. To identify an appropriate laboratory technique
      c. To identify appropriate materials

B. Securing research funding or collaboration
   1. To obtain background facts to include in a grant proposal
   2. To obtain information to justify the significance or appropriateness of a proposed study
   3. To provide justification for some aspect of a proposed research design or methodology (including submission to FDA for investigational drug)
   4. To identify information to evaluate potential for collaboration with other researchers
   5. To identify the expertise/interests of potential reviewers in order to decide on the agency component from which to seek funding

C. Performing analysis of published information
   1. To perform an analysis of previously published research findings
   2. To perform an analysis of medical views or opinions
   3. To perform an analysis of research methods

D. Interpreting research findings
   1. To help refine a theory or model so that it can encompass new findings
   2. To help understand the significance of certain research findings
   3. To help interpret unusual findings

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E. Preparing research reports
   1. To determine whether results are sufficiently novel and should be published
   2. To place own findings in context of most recent research and opinion
      a. To review all current and significant work in own field
      b. To obtain specific citation(s) for work to be referenced in report of own findings

F. Evaluating research proposals or requests for approval of new drugs/devices
   1. To assist in study section review
   2. To assist in review of investigational drug application

III. Teaching

A. Instruction in the basic medical sciences
   1. To prepare a lecture for undergraduate college science course
   2. To prepare a lecture for medical school course in basic medical sciences
   3. To prepare a lecture for graduate student seminar
   4. To provide students with bibliographic materials to aid them in preparing a paper or thesis

B. Practical instruction in a clinical setting
   1. To obtain supplemental information pertinent to the care of patients on the teaching services
   2. To provide reference tools for students, residents, or faculty
      a. To provide students or residents with selected references or reference list
      b. To construct a special-purpose literature data base to provide students or residents immediate access to information on clinical questions

C. Continuing and inservice education of practitioners
   1. To obtain information to update practicing physicians on new diagnostic techniques or treatment modalities
   2. To obtain information to provide inservice education to non-physician health professionals and para-professionals

D. Didactic instruction of residents or faculty in a hospital, medical center, or other educational setting
   1. To supplement presentation of article in residents' journal club
   2. To prepare a presentation for a regularly scheduled teaching conference for residents
   3. To prepare for case or clinical conference
      a. To develop presentation concerning a specific case
      b. To provide input on specific issue at department conference
   4. To prepare a special clinical lecture, symposium, or grand rounds presentation for faculty, residents, and other health professionals
      a. To develop content of clinical lecture, symposium, or grand rounds for residents, faculty, or students
      b. To assemble visual materials to present in clinical lecture or symposium
      c. To locate a specific article or prepare a bibliography to distribute at clinical lecture
   5. Presentation of a comprehensive review at a professional meeting
E. Providing health and safety information to community and lay public
   1. To develop a lecture/course on health or safety for lay group
   2. To answer inquiry from lay public
   3. To present technical information to other pharmaceutical salespeople

F. Preparing a written communication on a clinical topic (articles, book chapters, reviews, etc.)
   1. To determine whether a disease presentation seen or treatment/procedure used by the physician was sufficiently unique to warrant a written communication
   2. To obtain an overview of topic area to support preparation of a paper, book chapter, etc.
      a. To obtain comprehensive information on a topic to include in a written communication
      b. To identify current information to update own state of knowledge
   3. To obtain specific data pertinent to the preparation of a written communication
      a. To obtain specific references to support case report on own clinical observations
      b. To obtain information to answer a specific question arising in the process of preparing an article or book
   4. To obtain proper bibliographic citations for previously identified articles

IV. Learning

   A. Furthering own formal education
      1. To obtain information pertinent to preparing paper or other report for graduate coursework
      2. To obtain information on areas of research interest of individual or laboratory being considered as location for fellowship or sabbatical

   B. Furthering own or other's continuing education
      1. To keep up to date in own primary area(s) of expertise
      2. To evaluate or demonstrate potential of Grateful Med to search literature
      3. To prepare for attending a professional conference
      4. To develop or maintain own database in area of interest

   C. Satisfying own curiosity or personal interest
      1. To learn more about some clinical problem of current interest
      2. To obtain more complete information on a brief item encountered casually
      3. To develop a more updated C.V.
      4. To obtain information on research interests of seminar speakers

V. Administration

   A. Standard setting
      1. To obtain information pertinent to determining optimal or most cost-effective treatment regimen
         a. To develop or modify therapeutic protocols
         b. To evaluate most efficacious pharmaceutical agent
      2. To obtain information pertinent to setting standards for use of personnel
      3. To obtain information on legal issues and liability relative to a particular patient-care policy
4. To obtain information on standards for precautions staff should observe to avoid exposure to possibly harmful agents

B. Evaluation of care
   1. To obtain information on national standards against which to compare performance of own institution
   2. To obtain measures to assess quality assurance
   3. To obtain information on possible sources of infection

C. Planning of facilities and services
   1. To obtain information on how to conduct strategic planning
   2. To obtain methods for hospital facility planning
   3. To help evaluate the rationale for a new facility or service

D. Personnel administration
   1. To help evaluate qualifications of a potential employee or colleague
   2. To obtain information to resolve personnel safety issues

E. Equipment purchase
   1. To obtain information pertinent to decisions regarding purchase of new equipment

VI. Other

A. Consultation to government agencies

B. Medico-legal consultations
   1. To help determine probable etiology of a contested injury or condition
   2. To help determine whether prognosis for particular condition was affected by delayed or incorrect diagnosis
   3. To obtain information to determine the appropriateness of care given
   4. To obtain information to assess future risk of a serious, life-threatening problem due to some agent
   5. To obtain information to aid in resolving a personal medico-legal matter

C. Personal business endeavors
Situations were also reported in which a patient came to the physician and had already been prescribed some treatment by another physician, a treatment with which the current physician was unfamiliar. Before continuing or altering the management of the patient, the physician needed to become familiar with the existing treatment.

There were a number of reports in which the decision regarding treatment related to whether a medical or surgical approach or both was most appropriate. For example, there were reports of a need for information that would help reveal the necessity or advisability of surgery versus medical treatment or no treatment at all. There were additional reports of the need for information on whether medical treatment, especially chemotherapy or radiation treatment for cancer, were needed in addition to surgery.

Finally, there were instances in which the patient had another disease or condition that raised a question in the physician's mind as to whether the usual treatment approach was still desirable or contraindicated.

Rare diseases and conditions exacerbate the need for information to use in planning and implementing treatment. Even physicians highly specialized in a given area may encounter problems they have never seen or have not seen or read about in so many years that they are concerned that they may not know of any more recent developments in treatment. The reports of such instances reveal that they may be "starting from scratch" and may need any possible information on the course and general management of the unfamiliar condition. This was especially true for rarer types of neoplasms. Where a patient had a relatively uncommon medical problem and either was pregnant or was considering becoming pregnant, there were instances in which the physician needed information that would indicate whether the pregnancy was likely to exacerbate the problem, increase the risk of recurrence of a cancer, or otherwise affect the choice of therapy or the potential of some adverse occurrence.

In some reports, the situation was a slightly different one in that the physician needed information on how a pre-existing medical problem would impact the management of a new problem that was the focus of the physician's current attention. In some cases, the physician was the primary care provider for a patient with a particular chronic condition, generally a somewhat unusual one, and wanted to be sure that his/her approach to the patient's overall medical care took the problem into account, e.g. that potential problems were anticipated or that any problems that arose were properly sorted out as being due to the existing problem or not. There were also a number of reports in which the patient was pregnant, and the physician needed to know how a particular medical problem or its treatment would affect the pregnancy or delivery and what special measures should be taken to manage the pregnancy and delivery appropriately. Other reports indicated a need for information on the special considerations for anesthesia management when surgery was to be performed on a patient with some additional medical problem, and a need for information on the prospects for the success of surgery for one problem, given the existence of a second, concurrent problem.

A number of reports concerned situations in which the physician had decided or nearly decided on the approach to be used but needed information on how to implement a specific treatment. The need might be for guidelines that would apply to the use of the treatment in a somewhat unusual situation, information that would help avoid some procedural mishap, information on the possible side effects of the treatment so that these could be anticipated and minimized, or information on whether
a somewhat novel use the physician was contemplating could be supported by
previous experience.

In many of the reports, the physician was already using or was familiar with
an available treatment for a medical problem but for some reason wanted to consider
an alternative. This might be because the physician had heard of a new and better
treatment not readily available in the U.S. or one with which he/she was simply
unfamiliar and needed to find out more about. The specific need might be for
information that would reveal whether the treatment was appropriate to a particular
patient or whether it might, in general, be of use to future patients with a particular
problem. Often these situations concerned the treatment of some form of cancer, and
this was particularly true when the physician needed to identify and evaluate possible
treatment alternatives when the standard treatment was not working or was causing
unacceptable side effects.

Three additional treatment situations were identified that led to the need for
information from MEDLINE. The first was a need for information on monitoring
procedures or techniques - exactly how and with what frequency to evaluate the
patient’s condition or response to treatment. The second was for prognostic
information so that the physician, and patient, would be aware of the latest statistics
and information on the probable outcome for a particular medical problem or the
relative outcomes for different treatment alternatives. And, finally, there were reports
of searches that were carried out in order to help the physician locate a particular
specialist to whom a patient could be referred.

C. Maintain an effective physician-patient relationship

Several different types of information needs were apparent that have been
grouped in the general area of maintaining an effective physician-patient relationship.
The first is the need for information that could be given to the patient, often in the
form of the actual abstracts or articles retrieved via MEDLINE, so that the patient
could better understand their condition and make informed choices regarding
treatment. A second need was in order to advise patients who had heard of a possible
treatment and were considering whether they should participate in a clinical trial of a
new therapy for a life-threatening condition. The third need reflected the fact that
physicians are often consulted by friends or family members for advice about some
medical problem or difficulty with the health care system. Often the question is
outside of the physician’s own specialty, and information is needed in order for the
physician to be responsive and to provide some degree of direction to the inquirer.

D. Prevent disease

Information is also sought from MEDLINE for the purpose of disease
prevention. Reports were obtained of instances in which the physician needed
information on health maintenance and primary prevention strategies. Some of this
information was needed in order to provide it directly to patients, and included
instances in which the physician was seeking appropriate patient education materials
(e.g. on cardiovascular disease risk reduction). Other searches were reported in
which the physician was seeking information in order to be able to evaluate life style
or environmental factors and their contribution to disease risk. There were also
reports of instances in which information was needed relative to improving the effect
of the hospital environment on the patient.
E. Discharge responsibilities to patients and third-party payors

Physicians not only submit billings for reimbursement of their own services; they also may be asked to provide opinions that influence whether reimbursement is approved or denied for services provided by another physician or health care provider. In the latter capacity, they may need information on whether a given diagnosis is a recognized medical entity or not or whether a particular treatment is considered appropriate by recognized expert bodies. Generally the need to render such judgments occurs when the physician is employed by the insurance carrier. Physicians may also be asked to provide opinions with respect to the status of their own patients that affect the patient’s entitlement to insurance benefits or their rates, and this may lead to the need for information that will help them render an appropriate judgment, for example, information on the prognosis for recurrence of a medical problem that has been quiescent for some period of time.

II. Research

The second major professional activity that generates the need for information from MEDLINE is research. The information needs in this area can be grouped into:
A. Research planning and execution (55% of research reports); B. Obtaining research funding or collaboration (15%); C. Meta-analysis of existing data (3%);
D. Interpretation of research findings (10%), E. Preparation of research reports (16%); and F. Evaluation of research proposals (1%).

A. Research planning and execution

In order to plan and carry out biomedical research, investigators must be knowledgeable about other research going on in their own and related fields. This takes many specific forms that are clearly revealed in the incident reports concerning MEDLINE searches. In deciding whether or not to pursue a given line of research, for example, an investigator may need information, beyond what he/she has at the time, that would indicate whether an important problem exists and whether there is a knowledge gap or controversy worthy of study. They may more specifically need to determine whether a study they are thinking about doing has already been done, or to determine whether any evidence exists already that would tend to support the validity of a given hypothesis they wish to test or the feasibility of undertaking a particular study at this point in time, e.g. whether the requisite methodology exists that would permit the study to be carried out successfully. All of these types of needs relate to determining whether a given research area is viable and a given study feasible.

Information may also be needed in order to narrow the scope of the potential research and to target it in such a way that it will be least redundant with other efforts and hence be most productive in contributing new knowledge and less wasteful of research funds and other resources.

Even given a defined and viable research problem, additional information may be needed. For example, information may be needed in order to formulate the specific questions that the research will attempt to answer. Or the issue may be one of choosing appropriate variables, factors or conditions (or more appropriate one than the investigator might otherwise use) for the research design. This may mean the identification of variables that should be manipulated in an experiment or factors that should be tested. It may also mean identifying variable and measures to use in
collecting data for non-experimental (e.g. epidemiological) research. The overall design of the study may also require motivate the investigator to seek information through MEDLINE. Such information may assist in the identification of an appropriate protocol, an appropriate laboratory technique different from that which the investigator has been using, or appropriate materials to use in some aspect of the study.

B. Securing research funding or collaboration

Obtaining support to carry out research or locating other investigators who may be interested in collaborating also motivates MEDLINE searches. The specific needs that were identifiable in the reports include obtaining specific background facts that can be included in a grant application, information that will help justify the significance or appropriateness of a proposed study, or information that can provide justification for some aspect of the proposed design or methodology to be used.

C. Performing analysis of published information

There were also reports of instances in which MEDLINE searches were carried out in order to do research on the body of existing, published research. This might be in order to analyze and evaluate previous research findings, to perform an analysis of trends or current views on some topic, or to perform an analysis of the research methods that have been applied to a particular problem.

D. Interpreting research findings

To be meaningful, research results must be related to other findings and to theory in a particular field; they must be interpreted by the investigator. A number of the MEDLINE searches that were reported were done to aid in such interpretation. In some instances the need that motivated the search was the need to refine a theory or model so that it could encompass the investigator's new findings -- findings that did not totally fit within any existing conceptualization. Other searches were done in order to help the investigator determine the significance of particular findings. Still others were occasioned by findings that were apparently unusual, and where the investigator needed assistance in their interpretation.

E. Preparing research reports

Another type of information need related to research that was identified in the incident reports concerned the preparation of reports of the research and its results. This included searches done for the purpose of determining whether the results were sufficiently novel that they were worthy of publication, as well as searches done to update the investigator on the most recent work in their field, so that their own findings could be placed in the most current context. These latter searches included ones that were a more open-ended search for all current and significant work in an area, as well as searches with a much narrower focus, directed at determining the proper citation(s) for work to be referenced in the report.

F. Evaluating research proposals

The final type of information need identified was related to the evaluation of research proposals. MEDLINE searches were reported that were done to support the investigator in the role of peer reviewer of other investigator's grant application, such as the determination of whether the applicant's review of the literature in a particular
area was complete or, in the case of the review of applications for certification of an investigational drug, whether the applicant's review of existing evidence of the efficacy and safety of the drug was complete.

III. Teaching

The reports of MEDLINE searches related to teaching revealed that they are done to support education throughout the continuum of training. The categories included: A. Instruction in the basic medical sciences (2%); B. Practical instruction in a clinical setting (4%); C. Continuing and inservice education of practitioners (13%); D. Didactic instruction of residents or faculty (27%); E. Providing health and safety information to community and lay public (3%); and F. Preparing a written communication on a clinical topic (50%).

A. Instruction in the basic medical sciences

Among the searches reported were a number that were done in order to provide content and other material for didactic instruction in the basic medical sciences. This included searches done to obtain information to support preparation of lectures in undergraduate college science courses, in medical school basic science courses, and for graduate student seminars. In addition, some searches were done primarily to provide students with bibliographic materials as a resource for them to use in the preparation of a paper or thesis.

B. Practical instruction in a clinical setting

The fact that MEDLINE searches are done to support didactic instruction of the sort just mentioned is not at all surprising. It may be somewhat more surprising to realize the clinical instruction "on the wards" also generates needs for information that are met via MEDLINE. Physicians reported carrying out MEDLINE searches in order to obtain information that could supplement the information they were providing relative to the care of patients on a teaching service, e.g. that would provide a broader context or perspective than was readily available using only the individual case. Others engaged in clinical teaching used the results of a MEDLINE search to provide reference tools for students, residents, or other faculty in the form of reference lists or, using the capabilities of various software packages, in the form of specially-constructed literature data bases pertinent to a given clinical area. An example of the latter type of information need was the retrieval of all MEDLINE citations and abstracts for a given time period for those journals contained in the departmental library, which then allowed for mini-searches on a hyper-card system and ready retrieval of the complete text of the desired articles.

C. Continuing and inservice education of practitioners

Physicians also reported searches that were done to obtain information to be used in the continuing education of other physicians, other health professionals, and paraprofessionals, and more specifically, to update them on new diagnostic techniques or treatment modalities, or on other topics related to patient care or to their own health and safety.
D. Didactic instruction of residents or faculty

Another type of teaching that leads to information needs and consequent MEDLINE searches is the great amount of didactic instruction of residents and faculty and medical students that occurs in the form of journal clubs, teaching conferences, case/clinical conferences, special clinical lectures or symposia, grand rounds, and at professional meetings. Thus a resident might report carrying out a search to supplement his/her presentation of an article in the resident's journal club. Or a faculty member might report that a MEDLINE search was done in order to obtain information needed for a presentation at a regularly scheduled teaching conference for residents. Other searches were reported in which an individual responsible for a case conference needed information to supplement the presentation of the individual case or to provide input on some specific issue to be discussed at a departmental conference. More formal presentations also were responsible for many of the searches reported. For example, searches were reported that were done because the individual needed additional content for a clinical lecture, symposium, or grand rounds presentation. Other searches had the narrower focus of identifying photos, charts, x-rays, graphs, and other visual materials for use in a clinical lecture. And yet others were done to locate a specific reference or reading/reference list to be distributed at the presentation. The broadest searches were those done because the individual was to present a comprehensive review of some topic at a professional meeting and needed to be sure that all relevant and important work was identified and evaluated for inclusion.

E. Providing health and safety information to community and lay public

Physicians often provide information to the public in the form of special lectures and answers to specific inquiries from community groups such as the Scouts. MEDLINE searches were reported that were conducted to support this type of public education, as well as searches done by non-physicians to support specific inquiries from physicians, e.g. inquiries to a pharmaceutical representative concerning a proprietary drug.

F. Preparing a written communication on a clinical topic

Written communications on clinical topics in the form of articles, books and book chapters, reviews, etc. serve an instructional purpose and hence are included under the general heading of Teaching. The preparation of such communications results in various types of information needs. For example, the decision as to whether a written communication is warranted at all requires a knowledge of whether a particular disease presentation seen by the physician or a treatment or procedure the physician is using is sufficiently novel that it is worth communicating in the form of a case report, treatment note, or letter to the editor. MEDLINE searches were reported that were done for the purpose of making such a determination. Others were done in order to arrive at an overview of a topic area to support preparation of a broader review in a paper, book chapter, etc. -- either with the intent of getting a comprehensive overview of the area or of more specifically updating the writer's knowledge. And others were done to retrieve a very specific bit of information that was needed, such as references to other reports of similar clinical cases to the one(s) seen by the writer or the answer to a very specific question arising in the course of preparing the written communication. And finally, there were reports of searches done primarily to obtain the proper bibliographic citation for some previously identified article being referenced in the new communication.
IV. Learning

While almost any MEDLINE search could be said to have occurred for the purpose of contributing to the searcher's knowledge, and hence to constitute "learning," a number of searches were reported in which the purpose was explicitly to advance the searcher's own education. The categories include: A. Furthering own formal education (19%); B. Furthering own or other's continuing education (42%); and C. Satisfying own curiosity or personal interest (40%).

A. Furthering own formal education

Health professions students, which in some cases included physicians obtaining further education in a field such as public health, reported MEDLINE searches that were done in order to obtain information needed in order to prepare a paper or other report. Others reported searches carried out for the purpose of being able to characterize and evaluate the research being done in a particular investigator's laboratory, in order that the searcher would have a better basis for determining whether that laboratory would be an appropriate place to further their own research training as a fellow or during a sabbatical period.

B. Furthering own or other's continuing education

A second type of learning purpose could be discerned in the incident reports, which was the furthering of the individuals own continuing education. Often the individual wanted information in their specialized area of expertise, in order to "keep up" with the field. This varied from those who do such searches on an ad hoc basis to those who search the literature at regular intervals using a fixed search strategy that they know from experience will retrieve material in which they are interested. Other searches reported were carried out in order to evaluate Grateful Med (e.g. by trying to retrieve material in a field with which the individual was very familiar -- where they "knew what should be there"), and a number of these searches were done for the benefit of demonstrating the potential of Grateful Med to another physician.

Prior to attending a continuing education program or professional conference, some of the reports indicated, an individual might carry out a MEDLINE search in order to be better prepared to understand and absorb the material to be covered and to contribute to the discussion. And, as in the case of searches done for a teaching purpose, there were searches reported in which the individual wanted to develop or update a data base of literature in some area of interest, so that this could be very readily accessed.

C. Satisfying own curiosity or personal interest

A number of the reports concerned MEDLINE searches that were done more informally -- much like browsing in the library. In some cases the individual wanted to learn more about some clinical problem of current interest. In other cases the search was stimulated by some bit of information that had been encountered briefly, where the individual wanted to follow up and learn more. This was especially true of information encountered on new treatments. Even more specific in their intent were the searches done to learn more about the treatment of a personal medical problem, to learn more about the research interests of a potential employer, to update the
individual's own curriculum vitae, or to obtain information on the research done by a seminar speaker who the searcher was considering for a presentation, needed to introduce, or who he/she needed to evaluate for some other reason.

V. Administration

Administrative activities carried out by physicians were also the stimulus for some of the MEDLINE searches that were reported. Purposes of these searches included: A. Standard setting (47%); B. Evaluation of care (18%); C. Planning of facilities and services (15%); D. Personnel administration (12%); and E. Equipment purchase (7%).

A. Standard setting

The development of protocols and institution-wide policies for patient care was the motivation behind a number of searches. This included searches to obtain information to help identify the optimal or most cost-effective treatment regimen, and, more specifically, the most effective therapeutic protocol or the most efficacious pharmaceutical agent. It also included searches done to set standards for the use of certain health care personnel, to obtain information on legal issues and liabilities related to an existing patient care policy, or to obtain information on safety standards for the protection of staff against infection.

B. Evaluation of care

MEDLINE searches were also reported that were done for the purpose of evaluating the care provided in an institution, i.e. for various types of quality control purposes. This included searches to locate the national standards against which the performance of a given institution could be compared, to identify the appropriate measures to use to assess institutional performance, and to obtain information on possible sources of contamination, generally occasioned by some untoward event such as an outbreak of infection.

C. Planning of facilities and services

Physicians involved in planning activities at their hospital or medical center reported searches done to provide information needed in this regard. For example, there were reports of searches done to obtain information on how to do strategic planning, to obtain methods for hospital facility planning, and to help evaluate the rationale for a new facility or service.

D. Personnel administration

Another category of administrative activities that was reported to have occasioned a MEDLINE search was that of personnel administration. This included reports of the use of MEDLINE to identify what research had been done by an individual, so as to evaluate their qualifications as a potential employee or colleague. It also included reports of searches done to resolve particular personnel safety issues, such as issues related to HIV infection.
E. Equipment purchase

A final category of information need in the area of medical administration was the evaluation of the merits of particular types of equipment in order to support a possible decision to purchase new equipment.

VI. Other

The final set of reasons for searching MEDLINE is a miscellaneous group. It primarily consists of needs that are pertinent to physicians employed as consultants or expert witnesses, or those working in settings such as law firms and federal regulatory agencies. The three types of information needs identified related to the following: A. Consultation to government agencies (18% of the "Other" reports); B. Medico-legal consultations (80%); and C. Personal business endeavors (2%).

Reports were obtained of searches done to document or support the counsel being given to a government agency (such as on nuclear reactor safety). Other searches related to specific legal actions, including searches done to help determine the probable cause of a contested injury or condition, to determine whether the prognosis for a condition was likely to have been affected by a delayed or incorrect diagnosis, to determine whether the care given to a patient met currently accepted standards, to determine the future risk of a serious or life-threatening condition due to exposure to some agent, and to help in resolving a personal legal matter. And, finally, there were searches done in order to obtain information that would further some personal business endeavor.
REASONS WHY THE INDIVIDUAL CHOSE TO DO A MEDLINE SEARCH

I. Why the individual wanted to access the journal literature

Figure 4 summarizes the types of answers given to the question of why the individual chose to do a MEDLINE search rather than obtaining the desired information from a colleague, textbook, or directly from their own journals. In many instances the individual responded as though the question were synonymous with asking why they had decided to go to the medical journal literature. And it is apparent, although hardly surprising, that one prominent reason for going to this literature is the desire for up-to-date information—information that has been published so recently or is accumulating or changing so rapidly that textbooks are out of date, colleagues cannot be counted on to be cognizant of the information, and the respondents cannot depend on their own reprint files to be sufficiently up to date. It is evident that this motivation is especially prominent when the information desired concerns cancer diagnosis and therapy or AIDS/HIV infection and treatment. Moreover, while many cited the inadequacies of textbooks 2-3 or 4-5 years old, others noted that their textbooks were 14-15 years old, and that, for cost and other reasons, they did not attempt to maintain a current collection.

A second prominent reason for going to the journal literature is because the individual wants to insure that s/he obtains authoritative information, e.g., "the opinions of all the experts." In this respect they cite colleagues as having limitations in terms of their memories (to say nothing of time limitations), and mention that the information colleagues provide is "filtered" and subject to that individual's opinions and experience. Interestingly, despite the availability of experts in an academic setting, in that setting colleagues' opinions were not always regarded as a sufficiently authoritative basis for decision and action.

Textbooks also are seen as being selective with respect to the information and references they include. And those seeking a comprehensive view are often aware that the topic of interest is "interdisciplinary" in nature and want to see how it is treated by various specialties. This is also likely to mean that their own journal and textbook collections, which are typically strongest in their own specialty, are inadequate to meet the need. In a number of instances the individual is seeking a review of a given area, and views a MEDLINE search as the only way of identifying such articles.

When the information desired is very specialized, or when the individual is specifically interested in primary data, other information sources are seen as having a variety of deficiencies. Textbooks are seen as necessarily general, omitting highly specialized information, and not dealing with rare problems in sufficient depth to meet the individual's needs. Colleagues, even specialists in the area in question, are frequently queried and found to be as much at a loss as the individual who needed the information, for a variety of reasons. The question may even have arisen out of a discussion among colleagues on how to handle a particular problem. And, in some cases, the search is done because the individual is attempting to evaluate the advice of such a colleague or consultant. Many respondents emphasized that there were instances where they wanted to draw their own conclusions by reading the original sources and examining the evidence, and did not want to rely on colleagues' "impressions."
Figure 4. Reasons Why Individual Chose to Do a MEDLINE Search (Rather than Use Other Means of Obtaining the Information)

I. Why the individual wanted to access the journal literature:

A. Wanted (very) recent articles/data
   - Field/topic/drug/procedure was too new or developing too rapidly to be in textbooks; textbooks can be out-of-date before they are published
   - Own textbooks are out-of-date
   - Own reprint files were not necessarily up-to-date
   - Own journals can’t give references to articles more recent than the submission dates of the articles in a given issue
   - Colleagues may not be aware of most recent information
   - Own medical center had not accumulated these data

B. Wanted to be sure to get all relevant articles—comprehensive and authoritative information
   - Wanted opinions of all the experts
   - Colleagues are helpful but can only give individual experience and opinions; colleagues are not an authoritative enough source in an academic setting
   - Colleague’s memory might not provide a complete retrieval of all relevant articles
   - Textbooks tend to be selective and omit references; textbooks aren’t necessarily comprehensive; textbooks describe “textbook cases,” not realistic diversity
   - Needed to see how issue was dealt with in various specialty areas and in ones outside range of own journals
   - Had exhausted the readily available resources and still wanted to know more

C. Wanted reviews
   - MEDLINE is the only way to specifically identify reviews
   - Colleagues are not a good source for a general overview

D. Wanted specialized information or primary data
   - Information was too specific to be in textbooks
   - Information in textbooks originates in journals
   - Information concerned problem too uncommon to be in textbooks, etc.
   - Information concerned new, very old, or unapproved drug not covered well (or not covered at all) in textbooks, PDR, Drugdex, hospital formulary, etc.
   - Information was not covered in relevant Cumulative Index
   - Textbooks did not cover topic well or at all; had only a few lines or a paragraph
   - Information not covered in CME classes
   - Colleagues didn’t have the information needed
     - colleague’s information not specific enough—too vague
     - colleagues gave wrong lead
     - colleagues not interested in particular aspect of problem, hence not helpful
     - colleagues didn’t have necessary interdisciplinary knowledge
     - colleagues don’t see this condition

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- colleagues' opinions were evenly split so no help; colleagues all have opinions
- individual uncertain whether consultant was correct; colleague's knowledge was not trusted
- rare, unusual problem beyond consultant's experience
- Wanted to draw own conclusions; didn't want colleagues' impressions or anecdotal input; wanted primary sources

E. Wanted a specific bibliographic item
• Wanted particular citation
• Wanted article(s) by specific individual/agency

F. Wanted some other information
• Wanted to locate an author
• Wanted to determine where a particular treatment or clinical trial is being carried out

G. Was searching the journal literature as part of a general information search process, educational process, or decision-making strategy
• For own learning or personal interest
• Was preparing for subsequent information-seeking efforts (as a first step in the process; a "good place to start")
• Wanted some information prior to consulting a(nother) specialist, especially those who would have written the key articles
• Part of the design of the research study was to do a literature search

H. Other reason
• Because the question wasn't urgent (or else would have used own network of consultants)

II. Why the individual chose to do an online search:

A. Ease/convenience of conducting search
• Requires much less work than does searching the literature manually
  - literature on topic was known to be sparse and physician was looking for a specific aspect of the problem
  - information on topic was likely to be found in too many different journals
  - manual search would have been "like looking for a needle in a haystack"; one "could spend a lifetime searching Index Medicus"
  - would have had to talk to too many people
  - the experts on topic are scattered all over the world; it's easier to get their articles
  - less work than going through own journals; discards own journals after scanning them; goes to journals after the MEDLINE search
• Allows going back in time a long way to get reports that are scattered or because of historical interest
• Provides abstracts that can be used to narrow down the articles that should be examined in full
• Easier than reviewing the literature via printed indexes (e.g., Current Contents, Index Medicus) or compendiums of abstracts
• Best way to access own journals; don't have to remember where an article was seen
• Department has resident librarian available to do searches; helpful librarians are readily available at hospital; process for requesting searches is very convenient and results are very good; can call and get search done
• When morning report cases deal with unusual diseases or unfamiliar treatments, institution always has a clinical librarian conduct a MEDLINE search
• Most easily accessible information source
• Allows one to scan a variety of relevant areas without going from textbook to textbook

B. Speed of conducting search and getting information
• Fastest way to get the information; to access the literature
• Faster than going through all of own journals to find a particular thing
• Faster than consulting colleagues; takes time and effort to get hold of them

C. Inexpensiveness of search
• Textbooks too expensive to maintain updated collection, even in area of specialty
• Search was free or of very low cost to individual
• Had a MEDLINE account
• Costs less than spending own time on manual search

D. Comprehensiveness and effectiveness of search
• Experience with MEDLINE has been good in past
• Ensures a thorough database re topic, doesn't miss anything; reduces anxiety that something has been missed
• Only way to cover journals comprehensively
• Topic had not been cited in journals regularly reviewed in own field
• Can get more than textbooks, own journals, or colleagues could provide
  - about what is currently being done
  - about a specific issue
• Searching Index Medicus manually is often unsuccessful in getting desired information
• Difficult to cross-reference manually using Index Medicus
• Covers foreign and foreign-language journals
• Recent books didn't deal with the topic well
• Books tend to omit references
• Most (but not all) of the journals of interest are in MEDLINE

E. Specificity of search
• No other source for finding review articles
• No other way to identify the most recent or up-to-date information

F. Resources available locally were inadequate
• Needed abstract(s) on articles in journals not obtainable from local library
• Other efforts hadn't turned up anything
• Difficult to get specialists to consult/call back regarding particular patient population (rural, indigent); MEDLINE becomes the consultant
• No board-certified specialists in this field in the state/area
• Nobody with relevant expertise in the city (large metro area)
• Individual was the local expert; no other colleagues would have had more information
• In a rural area, isolated, without a more knowledgeable colleague, a
  specialist, or many textbooks on the area in question (e.g., neurology,
  endocrinology, psychiatry); nothing else available
• Was located far from a medical library
• Journal/textbook collection of local hospital or practice library was very
  limited
• Worked in a setting with no ready access to medical colleagues (e.g.,
  government agency, occupational medicine clinic) despite being in a large
  city

G. Familiarity and availability
• Knows how to use MEDLINE; has enough skill to do it; was trained on it
• MEDLINE is available at institution
• Didn't know where else to look

H. Other reasons
• Wanted to download abstracts and citations into own data base instead of
  entering references by hand
• Wanted to develop a disk of backfiles of everything in area of interest and
  develop own data base of references
• Wanted to prove certain efficacy data actually existed in the literature
• "Why would I do anything else!"

III. Why the searcher used Grateful Med:

A. Convenience
• Search can be done on a PC, which is readily available (at home, in own
  office, at any time of day or night, regardless of whether library is open or
  colleagues are available)
• Saves time and trouble of going to the library, "filling out a slip and
  waiting three days"
• Had no time to go through the MeSH book to find the right subject
  headings

B. Speed
• Needed information very quickly; particularly helpful in a "hurry/urgent"
  situation
• Only way to get information in a hurry or at inconvenient time (e.g.,
  before going to hospital to see emergency patient in middle of the night; in
  the few minutes before beginning surgery; before patient leaves office;
  between patients; when an idea occurs; on a Saturday in a small town; at
  night, when doing writing)
• Can log on for about two minutes and get what is needed; otherwise it
  would take several days

C. More satisfactory results when doing own search
• Can put search through once (usually) and get what is wanted
• Because he/she knows how to use Grateful Med
• Takes longer to tell librarians what is needed than to do it oneself
• Can format the search more carefully than when using intermediary
• Because Grateful Med is the most user-friendly software

D. Cost
• Cost less than for librarian search/other search service
E. Was demonstrating, testing, or learning to use Grateful Med
   • Wanted to learn to use Grateful Med
   • Wanted to get needed practice (respondent was a library cataloger)
   • Wanted to test Grateful Med by searching an area where s/he knew the literature
   • Wanted to try out new version of Grateful Med
   • Wanted to show students, colleague, etc., how Grateful Med works, that they can get information when they're out on their own
Those who are seeking a specific bibliographic item—a particular article they had seen or heard about—but who lacked enough information to go directly to the appropriate issue of the appropriate journal tend to see MEDLINE as the only or certainly the most feasible way of identifying the complete citation. This is also true for those who are searching for all or some particular subset of the articles published by a specific individual. In the latter case their purposes range from trying to become familiar with the work of the individual with whom they are considering working or studying or who is coming to give a lecture, to expanding their own research perspective, to an interest in the perspective some individual might bring to bear on a matter of import to them (e.g., review of a grant application), and even to an interest in evaluating another individual's credibility (i.e., whether the person has done the research s/he claims or has purported knowledge and experience in a particular area). Another reason given for going to the journal literature is as a means of identifying the address of a particular author or the names and locations of institutions using a particular treatment or participating in a specific clinical trial.

In some cases, interviewees report that they go to the journal literature as part of a systematic strategy for information-gathering—as part of their own continuing education, as a first step in a series of information-gathering steps that might include conferring with colleagues, or as a means of preparation for or deciding about the necessity for consultation with another specialist. One of the more interesting comments made in this context was that the journal literature provides the basic information, while colleagues become more helpful at the stage of evaluation and decision-making.

II. Why the individual chose to do an online search

The question asked in the interviews about the reasons for conducting a MEDLINE search rather than using other means of obtaining the desired information was answered by a number of individuals in terms of their perception of the advantages of an automated retrieval system over searching the journal literature "by hand." The convenience of an automated search is the general advantage cited, but some of the other specific comments are of interest. Some searchers are looking for information that they know will be "sparse," which makes a hand search extremely onerous. The number of reports of specific cases of a rare disease treated in a particular way, for example, might range from zero to less than a dozen, and the individual would have great difficulty insuring that s/he found all such reports if forced to search manually. Those who are interested in obtaining multiple perspectives on a problem tend to cite the fact that they would have had to search through too many different journals, skim too many textbooks, or talk to too many different or widely scattered individuals to get what they wanted. The value of having abstracts readily available, as a means of identifying the most relevant articles, is also mentioned. And others consider a MEDLINE search more efficient than reviewing Current Contents or other printed indexes.

Related to the relative ease of conducting an automated search is the speed of doing so, as compared with consulting colleagues or with any other means of accessing the medical literature, including going through one's own journals to find some particular item that was previously seen. In other words, a MEDLINE search may be seen as the best way to access journal information, whether it is one's own journals or those in a library. The relatively low cost of searching was also cited.
"not so inexpensive that one can play," but relatively so considering the value of the individual's time). In some cases this results from the fact that the search was being paid for by an institution; in other instances the comparison is with the cost of maintaining an up-to-date textbook collection, even in the individual's own area of specialization or the cost in time of a manual search. The ability to do a more comprehensive and effective search was cited as a significant advantage over doing a search by hand or, as noted above, over consulting other human sources. The difficulty of cross-referencing in a manual search was also mentioned, as was the frequent lack of success in retrieving the desired information using Index Medicus. The inclusion of coverage of foreign and foreign language journals was also mentioned as insurance that the individual would obtain "everything that had been written."

Specificity of searching also figures in the advantages of an automated search in that the searcher can selectively identify reviews, can cross-reference to get the most pertinent material, and can insure that s/he obtains the most recent information. This emphasis on recency is such that a number of individuals reported frustration that something for which they were searching was too recent to have been added to the MEDLINE data base, although it is possible that the article in question was actually in MEDLINE and simply not retrieved for some other reason.

The inadequacy of local resources motivated many of the searches. The individual might be searching for the abstract of a paper in a journal not available in their local library. Many times the journal or textbook collection in their own or their institution's library was very limited and they were far from a medical library. Those in rural areas have this problem to a great extent, and have a lesser number of appropriate colleagues to query. In some cases there may be no relevant specialist in the entire state. Colleague availability can also be a problem for individuals working in agencies in large urban areas when they are the only medical staff, and, if the question is specific enough or concerns a rare problem, there may be no relevant specialist even in a large metropolitan area.

The fact that an individual is familiar with MEDLINE, knows how to search, and has enough skill to retrieve useful information is also a strong motivation to carry out searches. And finally, respondents cited the advantage of an online search in allowing them to derive a subsidiary literature data base suited to their own needs without having to enter the citations by hand.

III. Why the searcher used Grateful Med

There was a third perspective from which the question "Why MEDLINE" was answered, namely, why the individual chose to use Grateful Med as a means of conducting an automated search. The perception was widespread that using a PC was extremely convenient. It was seen as being available when and where it was wanted, and regardless of whether the library was open. Many users also had the perception that, using Grateful, they could do the search faster than they could have explained their request to a librarian. The fact that Grateful Med avoids the need to go through the MeSH book, they believe, and is "user-friendly" in other respects has obvious appeal. And there were individuals who mentioned that the particular search they were describing was done via Grateful Med because they had a new version of Grateful they wanted to try out, they were practicing with the software, or because they wanted to show someone else how to use it and its utility.
TAXONOMY: IMPACT ON MEDICAL DECISION-MAKING

The analysis of the impact of information obtained via MEDLINE on the decision-making of the individual who wanted the information has suggested that such effects divide naturally into general areas of professional activity similar to those that characterize the reasons for needing information: I. Patient care (41% of the reports), II. Research (21%), III. Teaching (22%), IV. Learning (7%), V. Administration (6%), and VI. Consultation (3%). The complete listing of the specific types of impact obtained is given in Figure 5. Brief statements that illustrate the kinds of incident reports that make up each of the categories in Figure 5 can be found in Appendix G.

I. Patient care

Figure 5 organizes the types of patient care decision-making that have been found thus far to be affected by the information obtained via MEDLINE searches into seven (7) major areas: A. Used the most appropriate diagnostic test (7% of the patient care reports); B. Recognized and properly diagnosed a medical problem or condition (22%); C. Developed an appropriate treatment plan (45%); D. Implemented treatment plan (14%); E. Maintained an effective physician-patient relationship (10%); F. Provided assistance in modifying patients' health behaviors (1%); G. Discharged responsibilities with respect to patient and third-party payors (1%).

A. Used the most appropriate diagnostic test

By virtue of the information they obtained via MEDLINE, physicians reported numerous instances in which they were able to make a better choice of diagnostic tests or procedures. Sometimes this meant that the physician discovered a test or procedure that s/he had never heard of, had been only vaguely aware of, or had heard of but had never used. This included instances in which the discovery of such a procedure and the acquisition of information about it provided an alternative to a more risky, painful or expensive test. Information also enabled physicians to perform and interpret a diagnostic test properly, even where it was a familiar test, and to develop diagnostic and monitoring capabilities that had not been available previously at their institution.

B. Recognized and properly diagnosed a medical problem or condition

Reports were also obtained of effects of the information obtained via MEDLINE on the process of reaching a diagnostic conclusion. For example, there were instances in which such information enabled the physician to determine that an observed condition was within the normal range or, alternatively, that a set of signs or symptoms constituted a recognized clinical entity. In some instances the information led the physician to conclude that proper diagnosis would require referral to another specialist.

The incident reports also included many instances in which the information obtained was key to reaching a diagnostic conclusion. This included instances in which it was key to interpreting the results of history, physical exam, and laboratory test results, led to the consideration of alternative diagnoses which the physician
would otherwise have overlooked, was essential to or helped in the elimination of a possible diagnosis or resolution of some apparent conflict in the diagnostic implications or laboratory reports, physical exam findings, or patient history, or enabled the physician to arrive at a diagnosis when, for some reason, it was not possible to perform the typical diagnostic procedure. Such information was also reported to have helped physicians avoid a premature diagnostic conclusion, and to confirm the suspected cause behind a diagnosed medical problem. Finally, there were instances in which the information helped confirm casual clinical observations about the association of particular signs and symptoms, thereby enabling the physician to better tailor the diagnostic (and treatment) approach to variants of a given medical problem.

C. Developed an appropriate treatment plan

Many reports were given in which information obtained via MEDLINE assisted the physician to develop a treatment plan. This included providing confirmation that the proposed management plan was, in fact, appropriate, that the usual approach was preferable to existing alternatives, providing support for the proposed approach to an especially rare or unusual condition, determining whether their own improvised treatment had been used previously and with what effect, or revealing a lack of evidence of the efficacy of a proposed therapy, leading to a decision against its use.

The development of a treatment plan was also affected by MEDLINE information in a number of other ways. For example, the information often enabled the physician to identify, evaluate and choose an alternative to his/her typical approach to a problem—to adopt a new and state-of-the-art therapy, to at least identify treatment options among which to choose, to alter or adjust the management of a common condition in some manner, to adopt a more conservative or aggressive treatment where indicated, or to identify an alternative treatment for a rare or unusual condition.

Specific parameters of the elected treatment were also adjusted based on information obtained via MEDLINE, such as the dosage of a drug, the route of administration, or a different regimen.

Individual characteristics of patients with the same ostensive problem can have a major impact on the appropriate treatment plan. Information obtained via MEDLINE was reported to have been used to select a treatment plan appropriate to the patient's age, pregnancy, previous history, concurrent medical problems, or the existence of and need simultaneously to treat multiple disorders. Information also enabled the physician to minimize the risks of the planned treatment by indicating the existence and magnitude of such risks, identifying the therapy with fewest risks or side effects, suggesting a treatment for potential problems, and identifying ineffective and risky non-medical treatments.

In a number of cases the physician was faced with an unusual, complex, or life-threatening problem and was unsure whether s/he could provide adequate management. Information obtained from MEDLINE searches was reported to have helped in some instances to identify an appropriate treatment, making it possible for the local physician to handle the problem. In other cases, such information led the physician to decide that additional information was needed before s/he could proceed,
Figure 5. Impact of the Information Obtained from MEDLINE on Medical Decision-Making

I. Patient Care

A. Used the most appropriate diagnostic test
   1. Used a previously unknown or unavailable diagnostic test or procedure
   2. Used the most sensitive and specific diagnostic test(s) or workup for suspected condition
   3. Performed or interpreted diagnostic test properly
   4. Evaluated new laboratory test for adoption
   5. Identified most appropriate test and where it could be performed

B. Recognized and properly diagnosed a medical problem or condition
   1. Recognized existence of an abnormal or normal condition
      a. Determined that an observed condition was within the normal range
      b. Determined that problem was a recognized clinical entity
      c. Determined that proper diagnosis required referral to another specialist
   2. Arrived at a differential diagnosis
      a. Identified the diagnostic and prognostic implications of specific history, physical exam, or test results
      b. Considered possible diagnoses that would otherwise have been overlooked
      c. Eliminated or was helped in eliminating a possible diagnosis/cause of a medical problem
      d. Reached a diagnosis by resolving apparently conflicting laboratory results, physical exam findings, or history
      e. Arrived at a diagnosis despite impossibility of obtaining the classical diagnostic information
      f. Avoided a premature or unjustifiable diagnostic conclusion
      g. Confirmed the suspected cause of a diagnosed medical problem
      h. Confirmed a casual clinical observation about the possible association of particular signs/symptoms, leading to adoption of diagnostic procedures to identify appropriate management in such instances

C. Developed an appropriate treatment plan
   1. Confirmed the appropriateness of therapy selected to treat a particular problem
      a. Confirmed that the original treatment plan was correct
      b. Confirmed efficacy of usual treatment after exploring alternatives
      c. Obtained support for proposed treatment of rare/unusual condition
      d. Decided against a proposed therapy for lack of supporting evidence
   2. Identified, evaluated, and chose an alternative to own approach to treatment of a problem
      a. Identified and implemented a new (state-of-the-art) treatment regimen
      b. Identified other treatment options among which to choose
      c. Changed the management of a common condition
      d. Confirmed the efficacy of a more conservative therapeutic approach
      e. Chose to implement a more aggressive therapeutic approach
      f. Chose an appropriate alternative treatment for a rare, unusual condition
3. Adjusted the proposed therapy to improve effectiveness
   a. Chose the appropriate dosage of a drug that had previously been selected
   b. Identified a new route of administration for a known drug
   c. Chose a different dosage/regimen to yield a better response
4. Selected a treatment plan appropriate to condition of individual patient
   a. Chose therapy appropriate to patient’s age
   b. Chose therapy appropriate to pregnant patient
   c. Chose appropriate therapy in light of patient’s previous history
   d. Chose appropriate therapy in light of a concurrent medical problem
   e. Chose the correct regimen for multiple disorders
3. Minimized risks of treatment
   a. Determined whether there was evidence of risk or side effects associated with planned treatment
   b. Selected therapy that would minimize potential side effects/risk/other adverse effects of treatment
   c. Provided treatment for anticipated or potential problem
   d. Identified ineffective or risky treatments for a medical problem (includes fads, notions, homeopathic remedies, etc.)
6. Determined limits of own capacity to manage patient’s problem and need for specialized care
   a. Identified appropriate treatment for a rare condition that the physician (specialist) had not previously treated
   b. Determined the need to seek further information from another source
   c. Made a decision that patient should be referred to specialist for management
   d. Identified and used new procedure that surgeon had not previously used

D. Implemented treatment plan
   1. Instituted prompt treatment of problem
      a. Began treatment earlier than would otherwise have been possible
      b. Chose the correct priority for treatment(s) in an emergency situation
   2. Provided appropriate monitoring of patient’s condition (12)
      a. Identified early symptoms indicative of a recurrence or exacerbation of a problem
      b. Determined the appropriate method and frequency of monitoring for potential side effects of treatment
   3. Evaluated and revised treatment plan as needed
      a. Identified a promising new treatment or variation when other options had proven ineffective
      b. Utilized a promising therapeutic agent not readily available in U.S.
      c. Chose a new treatment option when necessary, taking into account contraindications due to patient’s condition
      d. Insured that all possible treatment options were explored in the case of a seriously disabling or life-threatening condition
      e. Determined nature and extent of others’ previous experience with own improvised therapy
E. Maintained an effective physician-patient relationship
   1. Provided explanation of condition to patient or family
      a. Relieved patient or family anxiety
      b. Improved patient or family cooperation
      c. Involved patient or family in treatment decision
   2. Insured continuity of care for patient moving or traveling outside area

F. Provided assistance in modifying patients' health behaviors

G. Discharged responsibilities with respect to patient and third-party payors

II. Research

A. Formulated a research problem or hypothesis
   1. Determined whether research area was viable
   2. Found an entre into a previously refractory research area
   3. Determined whether a problem of interest had been adequately investigated or resolved
      a. Determined area was wide open for new research
      b. Identified a gap in existing knowledge open to new research
   4. Contacted colleagues to generate ideas

B. Sought research funding or collaboration
   1. Enhanced credibility by demonstrating full command of current state of the science in study area
   2. Justified the significance and/or appropriateness of a proposed research study
   3. Evaluated potential for collaboration with other researchers
   4. Secured review by most appropriate funding agency or agency component

C. Planned and executed the investigation
   1. Formulated specific research questions
   2. Identified important variables and control conditions
   3. Selected appropriate protocols and techniques
      a. Confirmed safety of proposed research protocol
      b. Identified or developed a protocol, technique, or tool that rendered the research technically feasible
      c. Identified or developed best protocol or technique based on comparison of alternatives
   4. Modified planned procedures when warranted
      a. Incorporated a method, technique or equipment to solve a central problem in the investigation
      b. Substituted a method, technique or equipment giving better results than the one in current use

D. Executed secondary or meta-analysis of published data or research
   1. Performed meta-analysis to evaluate adequacy of existing research
   2. Analyzed attitudes and opinions as evidenced in published papers

E. Interpreted and reported results
   1. Developed an interpretation of research findings
      a. Identified a mechanism that would explain unusual or puzzling results
      b. Identified a model or theory that fit experimental findings
c. Developed or refined theory so that it would encompass new findings
d. Analyzed methodology in order to interpret research findings
2. Determined the significance of research findings
   a. Determined that findings had not been previously reported and should be published
   b. Determined that findings contradicted prevailing opinion and should be reported
   c. Determined that findings were worthy of further investigation
3. Prepared report of research
   a. Cited corroborating evidence from other studies in report of research findings
   b. Provided relevant context of other research in which to discuss methods and results in research report
   c. Avoided omission of other relevant research in report of research

III. Teaching

A. Provided instruction in the basic sciences
   1. More effectively prepared lecture for undergraduate college science course
   2. More effectively prepared lecture for graduate student seminar
   3. Provided students with bibliography to prepare paper

B. Provided clinical instruction
   1. Supplemented own or resident's clinical teaching on the wards
   2. Prepared educational resource for use by students, residents, or faculty
      a. Provided students/residents with selected references or a reference list
      b. Provided students/residents with special-purpose literature database
      c. Prepared or assembled bibliography to supplement a presentation
   3. Prepared clinical lecture or graduate symposium
      a. Developed content of talk
      b. Assembled audiovisual materials
   4. Prepared for case/clinical conference
      a. Augmented own information on case and management
      b. Provided input on specific issues related to case
   5. Prepared broad review for major professional presentation
      a. Incorporated additional information in presentation at grand rounds
      b. Incorporated additional information in presentation at teaching conference
      c. Incorporated additional information in presentation at professional meeting
   6. Supplemented discussion of article in journal club

C. Provided inservice/continuing education to clinical personnel
   1. Provided education on diagnostic techniques
   2. Provided education on therapies
   3. Provided education on a disease entity
   4. Provided education on a professional activity

D. Provided education for inservice/continuing education to community health care or public health personnel
E. Provided educational services to the community and lay public
   1. Developed and presented health education lecture/course for lay community
   2. Provided information/advice to address inquiry from lay public
   3. Provided technical information to pharmaceutical salespeople

F. Initiated an article or case report
   1. Determined that own clinical observations or approach was sufficiently novel or important to be worth contributing to the literature
   2. Supplemented report on own clinical experience with supporting information from others’ experience or research findings

G. Prepared a current and authoritative review of a topic in the form of an article, book, or book chapter
   1. Easily and efficiently assembled information necessary to preparation of a published review
   2. Organized manuscript effectively
   3. Incorporated most recently published information on topic
   4. Incorporated information that insured that review was comprehensive
      a. Incorporated complete set of references on topic
      b. Incorporated most authoritative information on topic
   5. Incorporated specific information that s/he had not previously known into review
   6. Incorporated current, accurate information on topic that was somewhat outside own area of expertise
   7. (Unable to determine appropriate title to be given to book in preparation)
   8. Responded to reviewer’s comments on review article

H. Carried out bibliographic analysis—determined trends in numbers and types of publications on particular topic

IV. Learning

A. Furthered own formal education
   1. Prepared paper or other report for graduate coursework
   2. Characterized research areas of individual or laboratory being considered as location for fellowship

B. Furthered own informal, continuing education
   1. Kept up to date in own primary area(s) of expertise
   2. Evaluated or demonstrated potential of Grateful Med to search literature

C. Satisfied own curiosity/personal interest in a particular topic or phenomenon
   1. Learned about some clinical problem of current interest
   2. Obtained more complete information on a brief item encountered in print or via casual comment or question
   3. Learned about treatment for a personal medical problem
   4. Updated own curriculum vitae
V. Administration

A. Formulated a strategic planning process

B. Addressed personnel matters
   1. Evaluated qualifications of potential employees or consultants
   2. Resolved personnel safety issues
   3. Determined personnel needs and utilization

C. Established standards, policies, and procedures
   1. Determined most appropriate therapeutic agent or procedure
      a. Determined which agent or procedure was more effective
      b. Determined which agent or procedure was safer
      c. Determined which agent or procedure was more cost-effective
   2. Developed quality control measures
   3. Developed precautions to avoid exposure by staff to possibly harmful agents

D. Developed basis for establishment of a new facility or service

E. Evaluated efficacy of a governmental program

F. Performed editorial duties for a journal

G. Made determinations on investigational drug application

VI. Consultation

A. Provided medico-legal consultation
   1. Determined probable etiology of a contested injury/condition
   2. Determined whether prognosis for particular condition was affected by an incorrect or delayed diagnosis
   3. Determined appropriateness of care given

B. Provided medical consultation to governmental agency
that the patient must be referred for specialized care, or to undertake a new surgical procedure that s/he had never attempted.

D. Implemented treatment plan

The list of ways in which information obtained via MEDLINE had an impact on the implementation of treatment of a medical problem consists of a number of specific subcategories. The first such category is insuring prompt treatment, allowing the physician to begin treatment earlier than s/he otherwise could have, and setting the correct priority for emergency treatment of multiple problems. The second category involves monitoring of the patient's condition, and involves choosing the appropriate method and frequency for monitoring and identifying early signs/symptoms of a recurrence of exacerbation.

The third type of impact is in helping the physician to evaluate and revise the treatment plan when necessary, by identifying a promising alternative when other options have proven ineffective or have failed after some period of positive response, selecting a new drug not yet readily available in the U.S., and selecting a new treatment alternative when this is complicated by the fact that certain options are contraindicated by the patient's condition. Information garnered through a MEDLINE search also frequently provided insurance that all possible treatment options had been explored in the case of a terminal illness so that "there isn't something else out there" that the physician doesn't know about.

E. Maintained an effective physician-patient relationship

Among the reported impacts are also those on the physician-patient relationship, including the physician's ability to provide an adequate explanation of a patient's condition and thereby relieve the anxieties of patient and family, secure their cooperation, and better involve them in treatment decisions. This includes explaining how rare the condition is, its prognosis, and the nature and effectiveness of the treatments available. The effects on the physician-patient relationship also include insuring continuity of care for patients moving or traveling by identifying appropriate medical providers in the new or temporary location.

F. Provided assistance in modifying patients' health behaviors

Several reports indicated that physicians had used the information they obtained via MEDLINE to help motivate changes in patients' health risk behaviors.

G. Discharged responsibilities with respect to patient and third-party payors

The execution of their professional responsibilities often requires physicians to make decisions about matters that affect individuals' employment and eligibility for insurance coverage or their receipt of insurance benefits. A number of instances have been reported in which the information obtained via MEDLINE provided the means by which the physician could reach a defensible conclusion as to the patient's eligibility for worker's compensation, receipt of benefits, or the patient's rating with respect to insurance coverage.

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II. Research

The effects of information obtained via MEDLINE on the thinking and decision-making of researchers appear to fall into five major areas: A. Formulated a research problem or hypothesis (27% of the reports); B. Sought research funding or collaboration (15%); C. Planned and executed the investigation (28%); D. Executed secondary or meta-analysis of published data or research (5%); and E. Interpreted and reported results (24%).

A. Formulated a research problem or hypothesis

One of the frequently reported ways in which MEDLINE affects the thinking and decision-making of researchers is in the formulation of potential research problems or hypotheses. As a result of the information obtained, the reports indicate that researchers have determined whether a particular research area is viable (i.e., whether it appears that the existing state of knowledge and methodology provides a basis for further investigation), have found an entry into some problematic research area by identifying a way around a methodological bottleneck or stimulating a creative reconceptualization of the problem, and have determined whether a problem of interest has been adequately investigated or whether there were gaps in knowledge in an already well-researched area or opportunities for totally new research and development. Information obtained via MEDLINE was also reported to have enabled researchers to contact potential colleagues working in particular substantive areas in order to generate ideas for research.

B. Sought research funding or collaboration

Information obtained via MEDLINE also was reported to have affected decisions and actions in what might be termed "grantsmanship" activities. This has included enabling the investigator to demonstrate, in a grant application, a current command of the subject matter in a particular research area and to formulate arguments and marshal facts in support of the significance of a proposed study and its appropriateness in light of the current state of the science. Information from MEDLINE has even helped investigators evaluate the potential for working with particular collaborators, in terms of the subject matter, methodologies, and quality of their work, and to evaluate the particular agency component or study section most appropriate for submission of their application for funding by revealing the areas of expertise and perspectives of persons serving on the various review bodies.

C. Planned and executed the investigation

MEDLINE searches have been reported that indicate a direct impact on the planning and execution of research—the formulation of specific research questions the identification of relevant variables and control conditions, and the selection of appropriate protocols and techniques. The latter includes several distinct types of effects—confirming the safety of the proposed protocol, developing tools to make the study feasible where it otherwise would not be, and selecting the best protocol based on a comparison of alternatives.

For research in progress, MEDLINE searches and the resultant information have helped researchers to modify their planned procedures to take advantage of new knowledge obtained by others and to incorporate some methodology that would solve
a central problem in the investigation or lead to better results than the current technique being used by the investigator.

D. Executed secondary or meta-analysis of published data or research

At times the information in the articles obtained via MEDLINE becomes itself the raw data for research or meta-analysis. Two specific uses of such information that were reported are the analysis and evaluation of the methodological adequacy of research to date in a particular area and the analysis of published attitudes and opinions on some topic--either current opinion, the historical development of opinion, or differences in viewpoint among writers.

E. Interpreted and reported results

The interpretation and reporting of research findings have also been observed, in the incident reports, to have been significantly affected by the information obtained via a MEDLINE search. Researchers have been assisted in interpreting their data--identifying a mechanism to explain puzzling results, finding a model or theory that encompasses their findings, advancing theory in the area in question, or providing assistance in analyzing their and others' research methodologies in order to help interpret their findings.

Determining the significance of research findings depends on an understanding of what is already known or not known and what other researchers are doing. Researchers turn to MEDLINE to update and expand their understanding in their area and related areas, and as a result, report being able to decide that their findings are novel or contradict prevailing opinion and should be reported in the literature or decide that the findings are promising and worthy of further investigation. When actually preparing a report of the research findings, information from MEDLINE was reported to have provided corroborative evidence from other studies, a context in which to describe the methods and results, and means of avoiding omission of reference to other relevant research.

III. Teaching

The specific educational activities and decisions influenced by information from MEDLINE are very broad. They include the following eight categories: A. Provided instruction in the basic sciences (2% of the reports); B. Provided clinical instruction (29%); C. Provided inservice/continuing education to clinical personnel (14%); D. Provided education for community health care or public health personnel (1%); E. Provided educational services to the community and lay public (6%); F. Initiated an article or case report (13%); G. Prepared a current and authoritative review of a topic in the form of an article, book, or book chapter (34%); and H. Carried out bibliographic analysis--determined trends in numbers and types of publications on particular topic (1%).

A. Provided instruction in the basic sciences

The incident reports include a number of examples of the use of information obtained via MEDLINE to further the science teaching of college students, medical and graduate students. In this case the typical teaching activity affected is the
preparation of a lecture, and the information is usually used to update or help organize the material presented; or to provide students with a bibliography for them to use in a class assignment.

B. Provided clinical instruction

The impact of MEDLINE information on clinical teaching—on the wards or in other related settings—is evident in a number of different ways. Reports include instances in which the information obtained was used to supplement the physician’s own clinical teaching or that being provided by a resident by bringing in an historical perspective, treatment alternatives, or other material that would expand upon the implications of the case at hand. The reports also include instances where the information was used to prepare an educational resource for use by students, residents, or faculty—a reference reading list, a specially tailored literature database, or a bibliography to supplement a presentation.

MEDLINE information was also reported to have been used to develop the content of a lecture and as a source of illustrative AV material to accompany the presentation. In preparing for case conferences, physicians were able to augment their own store of information of the case and management with information from MEDLINE or to provide input on specific issues for a case conference. The preparation of a major professional presentation for grand rounds, a teaching conference, or professional meeting was also reported to have been affected by the results of a MEDLINE search. New information was often incorporated, and the organization of presentation was also improved by having the results of a broad review of the literature. And there were reports of searches whose results were used to inform the discussion of a specific article at a journal club meeting.

C. Provided inservice/continuing education to clinical personnel

Physicians play a role in continuing education, not only of other physicians but of staff in their hospitals and clinics. They report instances in which they used the information obtained via MEDLINE to instruct such staff on diagnostic and therapeutic matters, on particular diseases, and on the activities and roles of health professionals. Frequently this was done as a brief series of talks on some problem or a brief orientation to a new procedure or piece of equipment being installed.

D. Provided education for inservice/continuing education to community health care or public health personnel

and

E. Provided educational services to the community and lay public

In similar fashion, physicians report instances of use of MEDLINE information in education they carry out within the community for other health care and public health personnel, as well as for the lay public. The latter includes use of the information to develop a lecture or course, to answer a specific inquiry, or to inform drug detail persons (pharmaceutical sales people).

F. Initiated an article or case report

The remaining teaching activities affected by information from MEDLINE relate to the preparation of written materials designed to educate the wider
professional community. Reports indicate many instances in which the information affected the very first step in this process, namely, the decision as to whether a written communication was warranted—whether there was something new or worthwhile to communicate regarding the physician's clinical observations or approach to treatment. Also, information was used to supplement the physician's own observations with supporting clinical or research findings.

G. Prepared a current and authoritative review of a topic in the form of an article, book, or book chapter

The preparation of a review article, book chapter, or book is an academic effort that typically causes individuals to access the journal literature. The specific actions and decisions affected, according to the incident reports, include assembling the necessary background material, developing a perspective that suggests an effective organization of the material, incorporating the most current and complete information, and incorporating information that was newly discovered in the course of reviewing the literature and would not otherwise have been discussed, determining an appropriate title for the paper, and responding to reviewer's comments. In some instances, the writer was moving outside his/her own area of expertise to cover related matters; the literature search enabled the inclusion of accurate content and provided reassurance that this was the case.

H. Carried out bibliographic analysis—determined trends in numbers and types of publications on particular topic

For certain purposes the analysis of trends in publications can be important in supporting a thesis or providing historical background. This may encompass an analysis of scientific content from the text of the papers or a bibliometric analysis.

IV. Learning

Evidence of the impact of MEDLINE information on the searcher's learning was also obtained. As noted above, of course, most of the reports indicate that something was "learned." Here we are concerned, however, with those reports in which the respondent specifically focused on this as the primary impact of the information. The three categories are: A. Furthered own formal education (21% of the reports); B. Furthered own informal, continuing education (40%); and C. Satisfied own curiosity/personal interest in a particular topic or phenomenon (39%).

A. Furthered own formal education

Two types of impact on the formal education of MEDLINE users can be discerned thus far—the use of information from the journal literature to prepare a paper/report or carry out a classroom project, and its use in planning further education, notably, in evaluating and deciding on the laboratory in which an individual might want to work as a research fellow.

B. Furthered own informal, continuing education

Reports indicated systematic and periodic use of MEDLINE as a means for the searcher to keep up-to-date in a particular area. Often such individuals searched
on a regular basis (monthly or quarterly) to keep up with new developments. Searches were also carried out primarily to evaluate Grateful Med, either the individual's own capacity to use it or as a means of convincing another individual of its value. In these instances, the "impact" was due not so much to the content of the articles retrieved, but to whether the search "worked well," as judged against some criterion, for example, whether it retrieved all of the searcher's own publications, or all of the key publications in his/her area of expertise.

C. Satisfied own curiosity/personal interest in a particular topic or phenomenon

A number of reports were given in which the information obtained increased the searcher's understanding of a topic of interest but had no immediate practical import, instances in which it brought closure on some question triggered by a casual comment or an item noticed in print, and instances in which it provided information on treatment of a personal medical problem or for updating the searcher's own curriculum vitae.

V. Administration

Impact on administrative actions and decisions has been reported for all major areas of administration. The seven categories include: A. Formulated a strategic planning process (3% of the reports); B. Addressed personnel matters (10%); C. Established standards, policies, and procedures (63%); D. Developed basis for establishment of a new facility or service (17%); E. Evaluated efficacy of a governmental program (1%); F. Performed editorial duties for a journal (1%); and G. Made determinations on investigational drug application (4%).

VI. Consultation

The two areas of decisions related to non-direct patient care consultation that were reported to have been effected by information obtained via MEDLINE were: A. Provided medico-legal consultation (91% of the reports); and B. Provided medical consultation to governmental agency (9%).
TAXONOMY: IMPACT ON THE OUTCOMES OF PROFESSIONAL ACTIVITIES

Figure 6 contains the taxonomy of the impact of information obtained from MEDLINE on the outcomes of professional activities. Illustrations of these various types of impact can be found in Appendix H. The outcomes include: I. Patient results (42% of all incident reports); II. Research results (24%); III. Teaching results (23%); IV. Administrative results (9%), and V. Legal results (2%). A small percentage of incidents used in creating the preceding taxonomies (5%) had to be set aside and not used in generating the outcome taxonomy because the outcome was unknown. This is a very small proportion and attests to the success of the protocol, especially as revised after the pretest, and the success of the interviewers in eliciting the information where it could be given. Brief statements that illustrate the kinds of incident reports that made up each of the categories in Figure 6 can be found in Appendix H.

I. Patient end results

The following categories of patient outcomes were defined: A. Longevity (5% of incidents with patient outcomes); B. Abnormalities (24%); C. Symptoms (3%); D. Function (1%); and E. Process outcomes (67%). It should be noted that these general areas of patient outcomes are similar in certain respects to the end results of patient care defined by Sanazaro & Williamson.\(^8\)

A. Longevity

It is quite clear that there have been many instances in which the information obtained via a MEDLINE search was key to saving a patient's life. There were also reports of other instances in which the information prolonged the life of a patient with a terminal prognosis, generally by providing information on treatment options that were promising but would not have been considered otherwise.

B. Abnormalities

Only slightly less dramatic than the searches whose results had a profound impact on life or death are those in which MEDLINE information prevented the loss or unnecessary amputation of a limb, hand, or foot. In addition, there are numerous reports where information obtained via MEDLINE led directly to cure or complete recovery from some abnormality--either by providing the key to correct diagnosis (which led to selection of the correct therapy) or by suggesting the value (or lack of value) of a possible treatment. And there are many additional instances in which the condition of a patient was markedly improved, due to information obtained via MEDLINE, even though the abnormality could not be cured.

Some searches considered "effective" resulted in information on a treatment which the physician considered worth trying, but the ultimate outcome was that the patient's condition did not improve following the treatment. Conversely, this was also the outcome in some instances in which the search was described as "ineffective" because it did not yield the desired information (information which may or may not have existed in the journal literature accessible through MEDLINE).
C. Symptoms

and

D. Function

The information obtained via MEDLINE also was found to have resulted in the choice of therapy that in turn resulted in relief of the patient's symptoms. In many of the cases this involved symptomatic relief for a chronic condition which was not itself curable. The reports also include instances in which the primary impact of the information obtained was on the role functioning of the patient or the patient's family.

E. Process outcomes

It proved possible, in many instances, to attribute the outcomes of medical care very directly to key information supplied to the physician in a timely manner through a MEDLINE search. Not only was such attribution plausible, given the facts of the situation, but direct attribution was made by the individual providing the report. These sorts of reports were readily classified into the non-process categories that were discussed above, such as longevity, abnormalities, or symptoms and function.

However, there were many other reports of instances in which the eventual outcome of care— in terms of the patient's status— could not be as readily attributed to the information obtained. In many instances, patient status was determined by other factors, notably, the nature of the patient's medical problem, whether any effective treatment existed, whether some other intervening circumstance occurred, and, occasionally, whether or not a colleague or patient actually acted on the information provided by the searcher. In such cases, while the information obtained via MEDLINE can be said to have played an important role in determining the quality of care received by the patient and may have had other indirect benefits, it clearly cannot be claimed that it was pivotal in determining the patient's eventual status. For example, the patient's status may be as it would have been, but, because of the information obtained, some potential risk was averted. Or the patient may have died of an illness for which there is no cure. The information provided by a MEDLINE search may have ensured that everything possible was done for the patient, but even the identification of a new chemotherapy option may fail to improve symptoms even temporarily, let alone prolong or save the patient's life. In such cases, it would not be accurate or reasonable to attribute the patient's status— good or bad— to the information obtained (or not obtained) via MEDLINE. This would be especially inappropriate if, despite the fact that the patient died, the physician viewed the search as "effective" in revealing the state of the art with respect to therapy for that problem, or providing reassurance to physician and patient that no treatment option had been overlooked.

Another kind of incident report which raises the issue of how to treat patient outcome and status occurred when the search was a recent one, or when the time course of the patient's problem was a lengthy one, such that the final outcome was not known at the time of the report. The respondent, in providing the report, was typically clear as to the value of the information to him/her, regardless of the fact that the eventual status of the patient was unclear. Such problems also arose in some cases where research, administrative, legal, or other situations occasioned a search.
Figure 6. Impact of the Information Obtained from MEDLINE on the Outcomes of Professional Activities

I. Patient End Results

A. Longevity
   1. Life of patient(s) saved
   2. Length of life increased

B. Abnormalities
   1. Abnormality or disease prevented
   2. Patient cured or completely recovered from abnormality
   3. Patient improved or stabilized (but not cured) of abnormality
   4. No improvement of patient's abnormality

C. Symptoms
   1. Patient obtained partial or complete relief of symptoms
   2. No improvement of patient's symptoms

D. Function
   1. Role functioning of patient improved or protected
   2. Role functioning of family improved or protected

E. Process outcomes
   1. Patient or family knowledge, attitudes, and behavior
      a. Anxiety of patient and family relieved
      b. Patient or family understanding of condition or health risk enhanced
      c. Patient/family involvement in treatment decision enhanced
      d. Adherence to treatment recommendations enhanced
   2. Health care
      a. Unnecessary treatments or procedures avoided, minimized, or reduced
      b. Risks or side effects of treatment avoided, minimized, or reduced
      c. Duration or frequency of hospitalization minimized or reduced without loss of medical benefit
      d. Patient received different and more accurate diagnosis than otherwise would have been obtained
      e. Patient received different and better treatment or treatment recommendation than otherwise would have been obtained
      f. Patient received referral to appropriate specialist or treatment center
      g. Patients received care where they otherwise would have received none
   3. Cost of care, insurance, and reimbursement
      a. Cost of care minimized or reduced without loss of medical benefit
      b. Insurance benefits and reimbursement obtained appropriately
         (1) Patient's status with insurer decided appropriately
         (2) Reimbursement of patient and/or family for worker's compensation decided appropriately
         (3) Problems or delays for patient in securing insurance reimbursement avoided
         (4) Reimbursement of provider for unacceptable treatment prevented
II. Research End Results

A. New knowledge produced
   1. Theory developed or refined
   2. Basic biomedical knowledge produced
   3. Understanding of medical history or medical ethics enhanced

B. New biological products developed

C. Process outcomes
   1. New research area identified
      a. Evidence of importance of research problem obtained
      b. Evidence of lack of importance of research problem obtained
      c. Need for further research determined
      d. Need for preliminary research determined
   2. Appropriate research design formulated
   3. Methodological impediment to research progress removed
      a. New research methodology developed
      b. Existing research methodology adopted
      c. Existing research methodology applied to novel problem
      d. Access to materials obtained
   4. Interpretation of results clarified
   5. Relationship of ongoing research to other/previous research clarified
   6. Scientific communication prepared
      a. Research findings submitted for publication
      b. Bibliographical source documented
   7. Research support obtained
      a. Application for research support strengthened
      b. Application/review process facilitated
      c. Regulatory approval received
   8. Appropriate participants secured for research project or conference

III. Teaching End Results

A. Direct instruction (classroom, wards, grand rounds, lectures)
   1. Students, residents, or local medical colleagues gained better understanding of topics in basic biomedical sciences
   2. Students, residents, local medical colleagues, or other health personnel gained better understanding of clinical care
      a. Gained understanding of particular disease or condition (pathophysiology, diagnosis, natural history, prognosis)
      b. Gained understanding of (new) diagnostic procedure (e.g., indications, procedures for performing, interpretation of results)
      c. Gained understanding of management of a particular disease or condition (e.g., use of certain therapies, overall care of the patient, risks involved in management)
      d. Gained understanding of (new) therapeutic procedure (e.g., indications, dosage, efficacy, risks)
      e. Gained understanding of specific issues in health care delivery (organization of services, role of providers, role of patient and family)
      f. Gained understanding of specific issues in disease prevention

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3. Students, residents, physicians, or other health care personnel gained ability to access biomedical literature
   a. Gained appreciation of value of on-line medical information service for clinical care or research
   b. Gained better access to current literature in their specialty
   c. Gained better access to broad-based bibliographic information
   d. Gained better access to biographical information
4. Lay public gained understanding of health issues
   a. Gained understanding of use and possible risks of particular medical therapies
   b. Gained understanding of the positive outcomes or risks of particular health habits and behaviors
   c. Gained understanding of other general health issues

B. Professional writing (textbooks, non-research articles, case reports)
   1. Wide professional audience gained better understanding of clinical care
      a. Gained understanding of particular disease or condition (pathophysiology, diagnosis, natural history, prognosis)
      b. Gained understanding of (new) diagnostic procedure (e.g., indications, procedures for performing, interpretation of results)
      c. Gained understanding of management of a particular disease or condition (e.g., use of certain therapies, overall care of the patient, risks involved in management)
      d. Gained understanding of (new) therapeutic procedure (e.g., indications, dosage, efficacy, risks)
      e. Gained understanding of specific issues in health care delivery (organization of services, role of providers, role of patient and family)
   2. Wide professional audience gained access to clinical observations and case reports

C. Physician's own understanding

IV. Administrative End Results

A. Physician's own practice
   1. Physician altered care for specific condition
      a. New protocol/standards adopted by physician
      b. New equipment/technology adopted by physician
   2. Appropriate future employment pursued
   3. Physician's personal business endeavors benefitted

B. Hospital
   1. Personnel matters successfully resolved
   2. Hospital adopted or altered protocol/standards of care for specific condition
   3. Hospital continued to use existing protocol/standards of care for specific condition while maintaining quality of care
   4. Hospital set up new facility/service

C. Other institution or organization
   1. Personnel matters successfully resolved
   2. Government program policy established or revised
V. Legal End Results

A. Patient or physician effects
   1. Patient protected from adverse decision
   2. Physician protected from unwarranted legal action or adverse decision

B. Legal process
   1. Time and expense of questionable suit avoided
   2. Offenders tried on appropriate grounds
   3. Illegal business closed

VI. Outcome unknown or not yet determinable
In order to be able to accurately characterize the contribution of the information obtained via MEDLINE, outcomes were defined that relate to the process of patient care, research, teaching, etc., despite the fact that this resulted in some overlap with the taxonomy describing the impact of MEDLINE on professional decision-making. Such process outcomes are described below and include many extremely significant contributions of MEDLINE in the following areas: 1. Patient or family knowledge, attitudes, and behavior (11% of the reports with patient outcomes), 2. Health care (52%), and 3. Cost of care, insurance, and reimbursement (4%).

1. **Patient or family knowledge, attitudes, and behavior.** The incident reports give evidence of a number of different kinds of impact on the process of patient care. There were instances in which information obtained via MEDLINE led to an improvement in the patient's or family's knowledge, attitudes, or behaviors. This was sometimes manifest as a reduction in their anxiety and uncertainty, generally as a result of the physician being able to better inform them about the patient's problem, the available treatment, and the prognosis.

In other instances, the outcome of the information the physician obtained appears to have been a patient who was better informed regarding the origins of a problem and what to do about it, although the patient may or may not have chosen to act in accordance with the physician's recommendation. In other cases, the impact appears to have been one of motivating the patient or family to adhere to the treatment recommendation and enhancing the therapeutic alliance on behalf of the proper care of the patient. In still others, the physician reported that the family's involvement in the treatment decision was enhanced by the provision of information obtained from MEDLINE. In this regard it was mentioned that the "objectivity" of the search was helpful in giving patients and families a sense that they knew what other physicians and experts thought and what the facts or uncertainties were, rather than getting only the views of a single individual. By virtue of this, they were in a better position to understand and participate in the decision-making.

2. **Health care.** Reports were also obtained of instances in which the results of a MEDLINE search directly affected the quality of the care received by the patient. The types of outcomes identified included the following: A. Unnecessary treatments or procedures avoided, minimized, or reduced (9% of all reports with patient care outcomes); B. Risks or side effects of treatment avoided, minimized or reduced (7%); C. Duration or frequency of hospitalization minimized or reduced without loss of medical benefit (1%); D. Patient received different and more accurate diagnosis than otherwise would have been obtained (11%); E. Patient received different and better treatment or treatment recommendation than otherwise would have been obtained (16%); F. Patient received referral to appropriate specialist or treatment center (8%); and G. Patients received care where they otherwise would have received none (<1%).

A number of these reports cited instances in which, because the information was available, the patient received a different and more accurate diagnosis than he/she otherwise would have or a different and more effective treatment. For the incidents classified in this category, there was no clear indication that this made a significant difference in the eventual outcome. Usually the emphasis in the report was placed on the fact that the physician was exposed to new options of which he/she had been unaware or that the information from MEDLINE insured state-of-the-art management. In these types of reports, it typically is not clear that the outcome for that individual
patient was better than it otherwise would have been. However, one can reasonably
assume that there is (statistically) a beneficial effect of patients receiving, not merely
"the latest" in diagnosis and treatment, but newer approaches that have demonstrable
advantages when evaluated on groups of patients. The value of the physician being
sure that he/she is remaining current in the approach to management of particular
medical problems seems obvious—especially where this concerns problems seen
infrequently (e.g., "I didn't know what new approaches had come in since I was in
school").

Similarly, in those instances in which information obtained via MEDLINE led
to the patient's referral to a specialist or center that could provide better care than
could the referring physician, one would expect a resultant benefit to the patient.
However, the referring physician was not typically in a position to provide this
information, and so the benefits/outcomes cannot be more precisely categorized.

3. Cost of care, insurance and reimbursement. In many cases the
impacts classified above under health care have indirect economic implications (e.g.,
reduced hospitalization, reduced risk). In addition, there were other reports that
indicated that the direct impact of the information obtained was to decrease the cost of
care, lead to appropriate payment/denial of payments, or avoid loss of the patient's
income. With respect to medical insurance benefits, there were some reports where
the information confirmed and some where it challenged a patient's rating status with
an insurer, where reimbursement was obtained (or denied) under workman's
compensation by demonstration of work-relatedness (or unrelatedness) of a medical
problem, where significant emotional and financial costs associated with problems
and delays in obtaining reimbursement for medical care were avoided for families,
and where reimbursement of a provider for unacceptable treatment was prevented.

II. Research end results

Figure 6 and Appendix H indicate the types of research end results identified.
The effects include: A. New knowledge produced (including theory, basic
biomedical knowledge, and an understanding of medical history and ethics (6% of
reports with research outcomes), and B. New biological products developed (<1%).
They also include effects on C. Process outcomes (94%). The latter include the
identification of new research areas (20% of reports with research outcomes) -- their
importance or unimportance and the state of the science in a given field; the
formulation of appropriate research designs (6%); the advancement of research
methodology (17%), either the development of new tools or the adoption or
adaptation of existing methods; and the clarification of the meaning of research
findings and of the conceptual relationship of a given research effort to other/previous
research.

III. Teaching end results

The impact of information obtained via MEDLINE on the outcomes of
teaching is indirectly indicated in the incident reports. In most cases, the reports
indicate that the information enabled the teacher to prepare a more authoritative,
complete, accurate, effectively organized, better illustrated, or better documented
presentation—the kinds of effects inventoried previously when our frame of reference
was the impact on decision-making. The actual impact on the learner's understanding
or skills is rarely described, because, in most cases, the teacher does not know what was actually learned. It is analogous to the situation in patient care where it was only possible to determine that the information had affected the process of care. In most cases, what we know is that the respondent judged that the instruction provided was significantly better than it would otherwise have been, or that it was especially well received.

The kinds of effects on the process of teaching that were observed divided into three types. The first involved A. Direct instruction in the classroom, on the wards, grand rounds, lecture, or some other personal, verbal presentation (69% of teaching outcomes). The audiences varied, including medical students, residents, medical colleagues, and other health professionals, as well as the lay public. For health professionals, the impact was on their understanding of the basic sciences (5% of teaching outcomes) and of the full range of aspects of clinical care (43%), i.e., their understanding of particular diseases (17%), diagnostic techniques (5%), management (4%), specific therapies (8%), health services delivery (7%), and disease prevention (2%).

A third type of instructional outcome was identified in which students, residents, physicians, or other health care personnel gained in ability to access the biomedical literature (17% of teaching outcome reports).

Information obtained via MEDLINE also affected the lay public's understanding of health issues (5% of the reports of teaching outcomes) -- their understanding of the uses and risks of particular therapies, the positive or negative outcomes of certain health habits or behaviors, and of other general health issues.

Information obtained via MEDLINE also was reported to have had a significant impact on the results of another form of teaching, namely, physicians' B. Professional writing (30% of teaching outcomes). Such writing extends instruction to a wider audience of students and others via textbooks, articles, case reports, etc. The main outcomes appeared to be on the intended audience's understanding of clinical medicine (pathophysiology, etiology, diagnosis, treatment, etc.) and their access to potentially useful reports of cases or a series of clinical observations.

The final type of teaching outcome identified, on C. Physician's own understanding (1%), included instances in which the physician explored a topic of interest and thereby became or remained current on issues, treatment modalities, etc., even though no immediate patient problem was affected.

IV. Administrative end results

In the area of administration of health services, reports were obtained of outcomes affecting the following institutions: A. Physician's own practice (27% of the administrative outcomes); B. Hospital (65%); C. Other institution or organization (9%). The information affected the protocols and standards used in connection with specific problems (either improving these procedures or providing a sound justification for existing ones), equipment evaluation and acquisition, the roles and utilization of various types of health care personnel, and the development or operation of new services.
V. Legal end results

A number of incident reports concerned legal issues, and the types of impact can generally be divided into: A. Patient or physician effects (36% of legal outcome reports), and B. Legal process (64%). This includes instances in which individuals were protected against an adverse legal action or decision, a costly and questionable suit was avoided, offenders were tried on appropriate grounds, and an illegal business was closed.

Estimation of Degree of Impact

Two types of impact have been inventoried above--impact on the outcomes of professional activities and, in the preceding section, impact on professional decision-making. In both cases, some of the types of impact are, by their very nature, especially significant. Saving a life is one such example (IA, Figure 6), as is the identification of a potential diagnosis that would otherwise have been overlooked (IB2b, Figure 5). However, for most categories, the degree of impact is not necessarily evident from the description of the category. Therefore, 188 incidents were randomly selected and, for each, a subjective judgment was made as to whether the degree of impact was "high" or not (i.e., whether the information made a significant difference in the action taken or the outcome for the patient). The percentages where the results of the MEDLINE search were judged to have had high impact on either decision-making or outcome or both were as follows:

- Patient Care  48%
- Research  55%
- Teaching  27%

Since there were 421 respondents who were engaged in patient care (77% of all 552 respondents), and a total of 515 effective patient care incident reports, this means that approximately three of every five respondents doing patient care were able to identify at least one search having a high impact on patient care within the preceding year (91% of all reported searches fell within that period and 70% within the preceding six months). Similarly, about one in every two respondents who were engaged in any research reported a search that had high impact on this activity. Finally, approximately one in seven respondents who were engaged in teaching reported a search that had high impact on these teaching activities or their results.
RESULTS OF ANALYSIS OF INEFFECTIVE SEARCHES

The preceding results were based primarily on reports of MEDLINE searches that were effective, in that 86% of the reports were of this type. Ineffective searches were included, but were in the minority in the overall data base. However, the ineffective incidents were of value in another way. As a means of increasing understanding of what may be the cause of search problems, 26 incidents were examined that users reported as ineffective, where a matching transaction log was also available. The goal of the analysis of these incidents was to characterize the nature of the ineffective searches, analyze the relationship between what the user said and what the transaction log said happened during the search, and ascertain, by performing an analogous MEDLINE search, whether a search could have been performed which would have met the user's objective. An additional goal was to try to identify the kinds of changes to the online search system software that could have minimized the number of ineffective searches, and to point out the areas in which the users seemed to be least cognizant of the current system's features.

Analysis of user interviews

Of the ten open-ended questions asked of users participating in the study, one concerned the way in which the search or its result was unsatisfactory to the user. Twenty-three of the 26 users responded that they could not find what they were looking for and/or could not find relevant materials. Two searchers felt the material they were looking for was too recent to be in the MEDLARS databases, three people felt they got too much extraneous material, and one person felt that the material he was seeking was not being indexed by MEDLARS.

Users were asked to describe the situation that led them to perform the online search and later to describe the outcome of the situation, given that they had performed the search and obtained ineffective results. In most instances the consequences of the ineffective search did not involve medical treatment. Nine respondents simply said they or someone else would have to try the search again to find the answer. Six respondents indicated they had to use manual literature search techniques to find the information they needed. Two users said that the consequence of not finding the needed information was to produce a paper that had incomplete references in it, and another two users stated they had deferred completing a paper because of the lack of information. Two other users stated that they actually were pleased with not getting any information because that helped verify the existence of a problem or gap in what was known about some subject.

Detailed analysis of searches

The methodology used to evaluate the searcher, searches, and system performance was to examine the transcription of the interview, examine the transaction log of the search, and to ascertain whether the search was conducted adequately or whether there were other problems that prevented the user from obtaining the desired information. These judgments were also informed by carrying out an analogous MEDLINE search and comparing the strategies employed and the results. It should be noted that, for searches done using Grateful Med, there are some limits to the level of detail about what the user did because user interactions
with the program do not all involve interaction with the ELHILL computer, and hence involve events not recorded in the logs.

Appendix I contains a summary of the specific conclusions reached concerning each of the searches. The first column of Appendix I contains complete quotations from the interview question "In what way was the search or its results unsatisfactory?" The second column is a brief analysis of the search and the search results.

There were six incidents reported in which the ineffective search had medical treatment implications. The user's descriptions of the situation that led them to do the search are recorded below.

- "I am preparing a presentation for grand rounds on a patient I have with peroxisomal disorder. Peroxisomes are intracellular organelles that can produce 45 different disorders in children, including dysmorphic features, enlarged livers, retardation, seizures, retinitis pigmentosa, etc. They are involved in the metabolic reactions of amino acids and fatty acids where the disorder can cause defects in embryogenesis." (036401).

- "I am clinical attending in the ICU and the house staff had a problem with a patient with Torsade de Pointes ventricular tachycardia, where height of top varies from beat to beat and the bottom looks like a wave. It occurs with anti-arrhythmic drugs and is life-threatening. I know the management but wanted reviews to teach residents." (039301).

- "A patient who had a heart transplant developed lymphoma. The transplant surgeons were treating the patient with acyclovir for the lymphoma because of the relationship to Epstein-Barr virus. They thought the lymphoma was caused by the Epstein-Barr virus. Fellow in hematology had never heard of this. Where did they get [the] idea to treat the patient this way?" (060402).

- "We had several children who presented with abdominal adenopathies. They had lymphadenopathies that looked like progressive transformation of germinal centers. It is unusual for these to present in the abdomen." (065801).

- "I had a patient with an unusual lower jaw tumor--an intrabony neurofibroma of the mandible. There are few reports of this tumor, and I wanted to see how it was treated in the past." (032703).

- "I'm working with a new device called patient-controlled analgesia (PCA). It's a computer-controlled infusion pump that allows us to put a large syringe of morphine in this pump, hooked to the patient's IV. So when the patient feels pain, they can press a trigger to self-infuse the drug to relieve their pain in a very safe manner. We are just starting to use this system, and I wanted to learn about what experience others have with PCA." (044801).

Incident number 036401 had a positive outcome from the search standpoint. The user did a very good search, repeated it to limit it to humans, and found only one
article that he felt was relevant. He was concerned that he had made a mistake in his search, but he did not and the search should be considered effective. There was no way for the user to know this to be the true situation, however.

In incident number 039301 the searcher reported that the patient "was treated successfully based on the knowledge we had. It was not impacted by lack of references." This search represents a situation where the ELHILL system failed to give the user adequate information. The system did not tell the user that Torsade de Pointes was a 'see' reference to tachycardia and the searcher became confused when he obtained materials on forms of tachycardia other than Torsade de Pointes. This problem could be corrected by having ELHILL tell the user about the cross reference.

Incident number 060402 is typical of many of the twenty-six that were examined. The searcher did not make effective use of MeSH. The searcher "...found no evidence for continuing acyclovir based on general literature and recommended that they stop." Conducting an analogous search on this topic retrieved a number of citations that were potentially relevant. This case is one where a lack of understanding of MeSH may have affected a medical decision. Further medical analysis would be required to clarify this.

In incident 065801 the searcher indicates that "There was no serious impact" of not finding citations on abdominal adenopathies that look like progressive transformation germinal centers. Later in the interview he reports that "The child got another lymphoma and was treated. Patient is doing fine now. Prognosis is uncertain; child may survive a few more years." Within this context, it would have been useful if the MEDLARS search had provided more information. The topic is difficult to search in MEDLARS, nevertheless the user took a very narrow approach, searched only MEDLINE, and omitted searching CANCERLINE.

Incident 032703 involved searching for citations about neurofibroma of the mandible. Like other searches described above, the user did not broaden his search enough to cover the possible ways the materials could have been indexed. He failed to find any relevant citations he could use to help him decide on the treatment of the tumor, but he was able to obtain useful information because, by chance, one of the latest journals he received contained a list of 40 cases that had been published on the topic.

The searcher in 044801 used the results of the search to prepare handouts on patient-controlled analgesia based on a MEDLINE search which used the wrong MeSH heading. There are no direct medical treatment implications, but there is a potential secondary effect if the trainers received limited information.

Conclusions about searching and indexing

Searching patterns. The most obvious conclusion to be drawn from studying the interviews and the transaction logs of all 26 searches is that users are relying on the use of text words in their search to the exclusion of understanding MeSH. Many users who reported ineffective searches do not seem to understand:

1. How to do subject searching.
2. How MeSH works.
3. How they can apply that understanding to map their search request into a vocabulary that is likely to retrieve considerably more relevant materials.

The medical community is extremely fortunate that NLM maintains MeSH, and yet the ineffective searches examined take little advantage of this essential and extraordinary tool. Many of the problems found could have been remedied by a better user understanding of MeSH. Undoubtedly, a majority of the future users of MEDLARS will not receive comprehensive training in the ELHILL system or in MeSH. Some way must be developed to convey the importance of MeSH to the users and give the users ready access to the MeSH structure. Strategies to accomplish this might include:

1. A redesign of Grateful Med to allow better browsing of the MeSH tree (beyond 'explode').

2. The graphic display of MeSH trees on Personal Computers, allowing users to point to the section of the tree to be used in a search.

3. Transmission of floppy disks or CD-ROM disks containing MeSH to Grateful Med users.

4. Provision of hard-copy editions of MeSH with Grateful Med subscriptions and a video or cassette tape explaining how to use it.

There are a number of more specific observations that can be made about the ways the users searched. These observations were derived from the analysis of the ineffective searches but appear to be more generally applicable:

1. Searchers are not always using the most appropriate MEDLARS file. Almost all searches start out in MEDLINE, but infrequently do the users shift to CANCERLINE, AIDSLINE, or CATLINE, for example, even though it might be very appropriate to do so. It is our impression that users do not necessarily understand the difference between these files.

2. When users search back files for the same information, they are not systematic. Several cases were found where one set of back files would simply be skipped. In addition, users usually do not take advantage of the stored search facility to rerun the same search on different files.

3. Some searches are sloppy. Example: a user does a search, obtains a retrieval set of citations, then does not look at the retrieved set. Example: a user will be inconsistent in the search strategy used in searching a series of back files on the same topic.

4. Users are not conducting interactive searches. An interactive search is one in which the user retrieves some information and then uses that information to revise the search strategy and searches again. An example of this is when a user retrieves some citations, displays a few of them, finds one or two that seem relevant, looks at the indexing of those that are found relevant, and revises the search to use the
indexing of the relevant documents. No examples of interactive searches were found in the sets that were examined.

5. Text word searching is one of the most frequently occurring methods of locating materials that was found in these reports. Users seem to assume that the form of a text word that they enter will be exactly the form that will be found in the file. They also do not seem to realize that a text word search only searches the title and abstract fields, not the MeSH fields. Truncation is not being used very often, yet it is a critical ingredient to successful text word searching.

Indexing. Half the problem in online searching is using the correct commands and terms to retrieve relevant materials. The other half is using the right terms to index the document. NLM exercises extraordinary control over indexing quality, but there are bound to be cases where the indexing that the user expects to be applied to a document and that which the indexer assigns to the document do not coincide, as well as indexing errors. Articles written in newly emerging fields, and articles that cross-over between existing fields, present problems for the indexer and the searcher. Searchers need to understand that they cannot expect one single search strategy to work to retrieve materials; they must try alternatives.
CONCLUSIONS

METHODOLOGY

This study has gathered detailed accounts of MEDLINE searches--their purpose, how they were carried out, what information was obtained as a result of the search, how this information was used, and what the ultimate effect was of having (or not having) the information on the situation that occasioned the search. From a methodological and substantive standpoint, it appears that this effort has been highly successful. Physicians and other searchers were responsive to being asked to provide the information; and the reports, as recorded, were sufficiently detailed and medically accurate to support the development of the intended taxonomies, as well as the development of case study abstracts based on the incidents.

On the other hand, it does not appear that respondents' unaided recall of the specific details of how a search was carried out can be assumed to be accurate. When the incident reports are compared with the actual traffic logs of the same searches, many inconsistencies in detail are apparent, although more so for certain parameters than for others. One would not want to rely on such reports, by themselves, in a study that was dependent on accurate and detailed information on the search process itself. Fortunately, MEDLINE traffic logs exist and can be accessed under some circumstances.

The present study incorporated such a detailed investigation of the search process as revealed in the transaction logs of searches considered by their originator to have been ineffective. This was combined with information on what the searcher was looking for and what s/he did as a result of the search gathered via the Critical Incident Technique. Supplementing both of these types of information by comparing the results of the original with the citations retrieved by an expert searcher attempting to obtain the desired information proved even more valuable, and resulted in a deeper understanding of the problems experienced by MEDLINE end users.

RESULTS

The primary result of this study was the creation of detailed inventories of:
(1) the reasons for needing information from MEDLINE, (2) the impact of the information on medical decision-making, and (3) the impact of the information on the outcomes of the situation that led to the search. In addition, the study inventoried the reasons why physicians turned to MEDLINE in order to obtain the desired information, rather than to some other source.

Reasons for using MEDLINE to obtain information. The delineation of the reasons why individuals turn to MEDLINE in order to obtain certain kinds of information clarifies the specific limitations of other sources and clarifies how MEDLINE, as a means of rapidly and effectively gaining access to the biomedical journal literature, may be uniquely able to fulfill information needs.
The first results of interest relate to why the individual was consulting the journal literature specifically, rather than textbooks, colleagues, or other sources. Frequently respondents stated that textbooks cannot be current enough or specific enough to answer the kinds of questions that generated these searches -- especially, their questions about very rare diseases, rare combinations of more common conditions, very recent developments in diagnosis or therapy, or questions involving highly specific information. These limitations were seen as inherent in textbooks/reference works, and were not simply the result of the limitations in the scope or currency of the physician's personal library or of the nearest medical library.

Limitations in available textbook and journal resources definitely existed, however, as well as limitations in the availability of appropriate colleagues, and many searchers turned to MEDLINE because of these limitations. In fact, it would appear that the textbook collections of many physicians, at least in some subject matter areas, date back 15 or 20 years -- to the period of their own training! Limitations on the availability of colleagues also were a key motivating factor for physicians in rural areas. Even in urban areas, physicians may work in agencies, organizations, or practice settings where they are the only medical staff. Such circumstances limit ready access to specialists who can answer a wide range of questions. Further, many physicians felt that both textbooks and colleagues offer a "selective" perspective, whereas, in the instances in question, they preferred to tap the original sources and variety of perspectives they could obtain by accessing the journal literature.

Those physicians who are end users clearly see advantages in being able to search themselves -- "in the time it would have taken to explain the information need to someone else". The fact that Grateful Med provides a means of getting critical information rapidly and at the time and place it is most needed -- outside library hours, in the physician's home, in the office between patients, and even in the ER -- was perceived to be of immense value. Many physicians indicated that personal access to MEDLINE has made a significant difference in the way they practice, and that they believe that all medical students should be trained in its use.

**Reasons for needing information.** The delineation of reasons for needing information focused on defining how the needed information fits into the process of patient care or other professional activities. The study provides especially important insights into the kinds of information needs that arise in connection with patient care. The 1987 NLM Survey of Individual Users revealed that 69% of direct users of MEDLINE indicate that patient care is a primary reason behind their searches and 36.5% rank patient care as the primary reason for searching. The present study reveals the kinds of specific patient care issues motivating these searches. The reasons span diagnosis and etiology, treatment and prognosis, the physician-patient relationship, disease prevention, and third party payment issues. And they concern issues central to the successful care of patients, both under circumstances where speed in obtaining information is critical and under circumstances when timeliness is merely an important consideration.

Similarly, the reasons for searching that relate to research make it clear that information is being sought to support all points in the research process -- from the identification of a problem, through the design, execution, and reporting of the study results, and including the search for funding and for productive collaboration with other researchers. The results of the study also detail the specific kinds of
information needs associated with teaching, administration, consultation, and other professional activities.

**Impact on medical decision-making.** The detailed inventory of ways in which the information obtained through a MEDLINE search affects medical decision-making provides further evidence that ready access to the information is, in fact, extremely important. Significant decisions are made concerning patient care, research, and other activities based on what the individual retrieves from or fails to find in the medical literature. Within the area of patient care, such information was frequently critical to choosing the most appropriate diagnostic test, reaching the correct (or any) diagnosis, developing a sound treatment plan, carrying out the plan, monitoring and revising it as needed, maintaining a good physician-patient relationship in which the patient's anxiety is minimized and the patient is able to participate knowledgeably in treatment decisions, insuring continuity of care, modifying the health risk behaviors of patients, and appropriately carrying out the physician's responsibilities with respect to medical benefits/reimbursement.

The search reports indicate that it would have been difficult, if not impossible, for the physician to obtain the needed information in any other way than through MEDLINE. Had that option not existed, in many instances the physician would have made an appreciably less effective decision, or had to proceed in the face of much greater uncertainty.

The use of information obtained via MEDLINE to support research, teaching, administrative, and consultation activities may be less dramatic than its use in connection with patient care. However, many of the decisions and actions taken in these contexts are quite significant. For example, such information was found to have affected the choice of problems a researcher studied, the design of the research, the pursuit of research funding, the choice of research techniques, and the explanation and interpretation of research findings. And, information obtained via MEDLINE also supported the training given to medical students, residents and other health professions students and practitioners, the education of the public, the furtherance of the searcher's own learning, the safe and effective operation of health facilities and services, and decisions taking place in federal agencies and elsewhere regarding investigational drugs and medical devices, environmental safety, and research funding, as well as legal decisions regarding physician, patient, and third party payor responsibilities.

**Impact on outcomes.** Even more than the preceding "decision making" taxonomy, the results concerning impact on medical outcomes makes it clear that the information obtained via MEDLINE has had important beneficial -- even life-saving and limb/organ sparing -- consequences for patients, as well as striking benefits in terms of reduced costs of care, the advancement of biomedical research, the quality of education received by health professionals in training, the quality of care given and efficiency of functioning of health care institutions, the outcomes of medically-related litigation, and the public's understanding of health issues. Those not directly involved in health care and biomedical research might tend to assume that access to the journal literature is primarily of academic import. However, the present inventory of ways in which this information has played a critical role in the outcomes of health care indicates that the impact is much more than academic -- in either sense of that term.
**User problems.** The special analysis of user-defined "ineffective" searches that were matched to transaction logs revealed some important ways in which current users may pursue search strategies that are not effective. Some users do not appear to understand how to do effective subject searching, how MeSH works, or how they can use an understanding of MeSH to map their search request into a vocabulary that will retrieve more relevant materials. When doing text word searches, many fail to truncate the words, which is critical to success in such searches. In addition, it appears that searchers are not always using the most appropriate MEDLARS files and may not understand the differences among the various available files. They also may misunderstand the domain of journals indexed in MEDLINE -- which journals are included and which not. When they use backfiles, it appears they may not be systematic and may fail to take full advantage of the stored search facility to rerun the same search on different files. And some searchers exhibit an inconsistency in their approach to searching successive back files or to the examination of the citations they retrieve that can adversely affect the results they get.

Another problem detected in this analysis was the tendency to rely on a "one shot" approach and not to do truly interactive searches. And, in general, the ineffective searches exhibited a tendency suggesting that users may not understand the limitations or specialized conventions of indexing, however well done, and thereby may fail to understand that they must try alternatives and not rely upon a single search strategy.
IMPLICATIONS

IMPROVING MEDLINE SERVICES

The results of the present study should be helpful to any effort to make Grateful Med more directly responsive to the needs of users. These results could, for example, inform efforts to develop problem-oriented "form screens" or improve training programs to make them more relevant to user needs, and could help to improve other MEDLINE services as well. Knowledge of the specific ways in which MEDLINE users apply the information they obtain should enable the Library to better insure that the search systems provided by the Library are as effective as possible and that they minimize the likelihood of obtaining unsatisfactory or misleading results.

In response to the identified user problems in searching, several suggestions have been offered in this report that can be incorporated into the user documentation or other training associated with Grateful Med. Additional suggestions have been offered with respect to the design of Grateful Med itself that might provide users with better access to the MeSH structure: a redesign to allow better browsing of the MeSH tree; graphic display of MeSH trees on Personal Computers, allowing users to point to the relevant section of the tree; providing Grateful Med users with floppy or CD-ROM disks containing MeSH, and supplying hard-copy editions of MeSH with Grateful Med subscriptions and including a video or cassette tape explaining its use.

The analysis of ineffective searches may also be of value in another respect. The incident reports suggest that some users don't realize (or forget) that MEDLINE does not encompass all of the journal literature that may be of use to them in connection with a particular issue (some know this but want it to be otherwise). A number of so-called ineffective searches appear to have arisen from this misconception. For example, a psychiatrist may be puzzled that they fail to retrieve known, key articles in their search and not realize that some psychological journals are not within the domain of MEDLINE. Another individual may consider that MEDLINE is "weak in the area of economics" but not know exactly what body of literature is covered or excluded. The identification of such areas of intersection with other disciplines as the origin of ineffective experiences with MEDLINE could suggest appropriate additions to user materials or the inclusion of referencing within Grateful Med to the appropriate additional sources. Selective expansion of the MEDLINE data base by linkage to other data bases is also possible.

INCREASING USE OF MEDLINE

The evidence of impact implies that increased use of MEDLINE by physicians could contribute significantly to the quality of patient care and to the reduction of health care costs. The information gathered on the reasons for turning to MEDLINE contains the germ of messages that could be used in promoting more widespread use of Grateful Med and MEDLINE by physicians. These reasons, offered by physicians who are users of MEDLINE and purposely retaining much of
their phrasing, may be especially useful in communicating the advantages of MEDLINE and Grateful Med to other physicians.

In addition, the results concerning the impact of the searches could be used to vividly communicate to potential users, including health professionals in training, the way in which facility in accessing the medical literature can play a significant role in their professional effectiveness and ability to keep current in their field. It is unlikely that the great diversity of effects revealed in the present study would be appreciated by many individuals, especially those still in training, and it seems quite likely that most individuals would find uses identified here that they would not otherwise have considered.

Rapid access to the biomedical literature, as documented in the present study, is not merely a convenience for health professionals. Although the economic and other benefits that result from a significant saving of physicians’ time are highly important, rapid and effective access to the literature also plays a determining role in key patient care decisions and in the outcomes of medical care, as documented in the present study. This is an especially serious matter in those areas of medicine in which rapid developments are occurring, and for physicians practicing in geographic or organizational circumstances that limit their access to other information resources.

Given the reports of MEDLINE searches obtained in the present study, it is easy to simply accept the view expressed that such access to the literature is an essential part of medical practice, until it is realized that the respondents are not typical of all physicians. Others, who do not use MEDLINE, undoubtedly have needs for information that are just as pressing. Those who search via librarian intermediaries are far better off than those who rarely, if ever, systematically consult the literature. However, there is a strong suggestion in the present data that such mediated searchers do not search as often, on average, as those who have elected to do their own searches. This further suggests that ready access to MEDLINE, at home or in the office, may actually encourage physicians to seek information, improving the quality of their decision-making and providing ongoing continuing education, with ultimate benefit to the quality of care received by their patients.

INCREASING SUPPORT FOR LIBRARY SERVICES

The results concerning the impact of these searches, based as it is on actual experiences of physicians and others, also should help in communicating to policy makers the practical impact of MEDLINE, including the impact on patient care, research, teaching, learning, administration, and other activities. Such documentation should communicate the value of the Library’s services to those in a position to affect its support more vividly than do anecdotal reports gathered in an unsystematic manner.

FUTURE RESEARCH

Although a primary focus of NLM in undertaking this study was to improve its services, it also appears likely that the results and the methods of the study also
will be of use in future research and development. The following describes some of the potential uses.

**Improvements to Grateful Med.** It has already been suggested that the inventory of reasons for searching MEDLINE provides information useful as a basis for designing features of Grateful Med to facilitate searching for specific types of purposes. Similarly, the information obtained from the analysis of ineffective searches indicates a number of ways in which the features of Grateful Med, its user documentation or associated user materials (e.g. MeSH materials), could be improved so as to decrease the likelihood that end users will be frustrated in their efforts or will use strategies that yield unsatisfactory results. The information resulting from this study needs to be translated into specific plans for NLM development and evaluation efforts that would produce such improvements.

The present results provide a kind of "baseline" against which the effectiveness of subsequent changes in MEDLINE and Grateful Med can be evaluated. And the methodologies of the present study could be utilized in the formative evaluation of such improvements. For example, a developmental sample of physicians who are MEDLINE end users might be selected. They would be studied as they utilize prototype versions of the system for real life information needs, either where they currently search or under more controlled laboratory conditions. Reports could be collected by phone or in person concerning the reasons for their searches and the impact of the results, as in the present incident reports. Transaction log and other data could be obtained that would indicate whether or not the new features were achieving the intended results of increasing searcher effectiveness and efficiency.

Unbiased estimates of the frequencies with which various types of information needs and impacts occur could be quite useful in setting priorities for the design of enhancements to Grateful Med. Due to the nature of the critical incident methodology, the present study cannot provide such quantitative estimates. However, the inventories developed here provide a sound basis for the construction of the requisite survey data collection instruments.

**Outreach efforts.** Another possible avenue for research is to use the present methodology as part of a more focused analysis of the information needs of physicians in specially targeted groups -- e.g., physicians in rural areas or other underserved areas, or physicians in training. For groups, such as rural physicians, who are already represented in the present sample but only in small numbers, the numbers could be increased by additional sampling from the defined survey respondent or new user populations. The value of such study would depend on the priority of a given group for NLM's outreach efforts and on the likelihood that the results would significantly augment those already obtained. It would be useful to combine such an effort with some investigation of the specific subject matter areas of most concern to the groups in question.

In recent years, the financial problems of small, rural hospitals have attracted attention. One side effect of this problem is that such hospitals frequently must cut back in certain areas, especially those that are not direct patient care. This has led to a significant decrease in the continuing education offered by these institutions. And it further exacerbates the usual problems of rural health care providers in obtaining the continuing education they must have in order to remain current, improve their capabilities, and maintain their licenses. It would appear that
many of the information and educational needs of rural practitioners could be better met by greater access to MEDLINE, underscoring the importance of effective outreach to these groups.

**Research on continuing education and clinical reasoning.** The present results also should be of significant interest to those who are interested in the clinical reasoning processes of physicians — in how such reasoning develops from novice to expert levels, and in how (or even whether) physicians incorporate new diagnostic and management techniques into their clinical behavior. Physicians such as the present end users, who have already incorporated online access to the medical literature into their professional lives, may be somewhat unique in their predilection toward self-motivated, lifelong learning, in their orientation to or comfort with technology, or just in some experience they had that started them doing their own MEDLINE searches. The present sample includes many individuals whose comments indicate that they view the use of Grateful Med and MEDLINE as being, as one put it, "as essential for a physician as the telephone book." A number actively attempt to convince their own medical students and residents of the value of doing their own online searches of the medical literature. Many medical educators would consider such behavior a desirable attribute of physicians and a central goal of education. Further study of this population to determine the origins of their own interest could further inform NLM's efforts to increase MEDLINE use by other physician end users.

**Use of the research data base.** The data base created as a result of this study exists in dBase IV and consists of records for each incident report that include the following information:

- the text of the incident report,
- the three taxonomic classifications of the incident,
- coded information on the incident, the search, and the searcher, and
- the "case study" abstract of the incident.

In addition, the three taxonomies are available in machine-readable and hard copy form, both as simple outlines and in a form that contains the ID numbers of all of the incidents classified into each category.

The primary data base will be accessible for a variety of purposes, including but not limited to:

1) the retrieval of incidents illustrating various types of information need, types of impact on decision-making, and types of impact on the outcomes of professional activities;

2) the retrieval of incidents illustrating the information needs confronted by particular kinds of medical specialists, physicians in particular practice settings (such as physicians practicing in non-metropolitan areas), or concerning particular topic areas such as AIDS or cancer;

3) further analysis of the relationships among user characteristics, search characteristics, and user information needs; and

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4) further analysis and classification of the incidents for purposes beyond those of the present study.

One issue that might be addressed by further analysis of the existing data would be to estimate the economic impact of MEDLINE, i.e., the costs saved due to the information retrieved and the way in which retrieval was accomplished. Some preliminary efforts are underway, using a sample of incidents, to define the types of direct and indirect cost savings that are mentioned in or suggested by these incidents and to determine how these might be estimated and for what proportion of the incidents. It appears possible that some valuation could be put on increased longevity, saved limbs/sensory organs, abnormalities avoided, risks averted, and patient role performance maintained (e.g., avoidance of lost work days/productivity). It also seems possible that the savings in reduced costs of care could be estimated in a rough manner, in many cases, and fairly precisely in some. This would include costs saved in avoidance of diagnostic and surgical procedures, hospitalizations, and average costs saved for care for diseases or other problems prevented. In addition, an attempt would be made to estimate the costs saved in getting the information via Grateful Med or a mediated search, as opposed to a manual method, if in fact it were even feasible to carry out a non-automated search with the same results.
APPENDIX A

LETTERS OF INVITATION
Date

Name
Address
Address

Dear Name:

I am writing to thank you for your valued participation in the National Library of Medicine's 1987 survey of MEDLINE users, and to invite your voluntary participation in a telephone interview that will give us further insight into the quality of your experiences using MEDLINE.

This interview is part of an important National Library of Medicine (NLM) study of how physicians and other health professionals use MEDLINE as part of their practice of medicine and other professional activities. During the weeks of [Dates], interviewers will be placing telephone calls to a selected sample of MEDLINE users to ask about the specific circumstances surrounding recent searches, including the usefulness of any information retrieved during these searches.

I expect the interview will take approximately 15 minutes. So that we may contact you at a convenient time, please return the enclosed form by [Date], indicating the best time(s) in the a.m. or p.m. to call. If this two-week period is not convenient, please indicate an alternative time period.

Your answers will not be maintained with any personally identifying information and will be available only to the researchers in the study, unless otherwise required by law. Study results will be presented only in the aggregate.

The NLM seeks to provide the highest quality information services possible. To do so, we need feedback from persons like yourself. I hope you will be able to help.

Sincerely yours,

Elliot R. Siegel, Ph.D.
Assistant Director for Planning
and Evaluation, NLM

encl.

cc: Director, NLM

The information collection in this study is authorized under Section 465 of the Public Health Service Act and the Office of Management and Budget. Clearance No. 0925-0323, expiration date 6/30/90.
Date

Name
Address
Address
Address

Dear Name:

I am writing to invite your voluntary participation in a telephone interview for an important study of MEDLINE users by the National Library of Medicine (NLM). Your responses to this interview will help us understand the quality of your experiences using MEDLINE.

We are particularly interested in learning how physicians and other health professionals use MEDLINE as part of their practice of medicine and other professional activities. During the weeks of [Dates], interviewers will be placing telephone calls to a selected sample of MEDLINE users to ask about the specific circumstances surrounding recent searches, including the usefulness of any information retrieved during these searches.

I expect the interview will take approximately 15 minutes. So that we may contact you at a convenient time, please return the enclosed form by [Date], indicating the best time(s) in the a.m. or p.m. to call. If this two-week period is not convenient, please indicate an alternative time period.

Your answers will not be maintained with any personally identifying information and will be available only to the researchers in the study, unless otherwise required by law. Study results will be presented only in the aggregate.

The NLM seeks to provide the highest quality information services possible. To do so, we need feedback from persons like yourself. I hope you will be able to help.

Sincerely yours,

Elliot R. Siegel, Ph.D.
Assistant Director for Planning
and Evaluation, NLM

encl.

cc: Director, NLM

The information collection in this study is authorized under Section 465 of the Public Health Service Act and the Office of Management and Budget. Clearance No. 0925-0323, expiration date 6/30/90.
Date

Name [UCLA SAMPLE]
Address
Address

Dear Name:

The National Library of Medicine is presently engaged in an important study to learn how physicians and other health professionals use MEDLINE as part of their practice of medicine and other professional activities. We would very much like your voluntary participation in a brief telephone interview so that you could help us understand the utility to you of the MEDLINE searches which you have done through your hospital librarian. You were identified by [Name of Librarian] at [Name of Library] as an individual who has recently requested MEDLINE searches, and who could provide valuable information.

During the weeks of [Dates], interviewers will be placing telephone calls to a selected sample of MEDLINE users to ask about the specific circumstances surrounding recent searches, including the usefulness of any information retrieved during these searches. I expect the interview will take approximately 15 minutes. So that we may contact you at a convenient time, please return the enclosed form by [Date], indicating the best time(s) in the a.m. or p.m. to call. If this two-week period is not convenient, please indicate an alternative time period.

Your answers will not be maintained with any personally identifying information and will be available only to the researchers in the study, unless otherwise required by law. Study results will be presented only in the aggregate.

The NLM seeks to provide the highest quality information services possible. To do so, we need feedback from persons like yourself. I hope you will be able to help.

Sincerely yours,

Elliot R. Siegel, Ph.D.
Assistant Director for Planning and Evaluation, NLM

encl.
cc: Director, NLM

The information collection in this study is authorized under Section 465 of the Public Health Service Act and the Office of Management and Budget. Clearance No. 0925-0323, expiration date 6/30/90.
Elliot R. Siegel, Ph.D.
Assistant Director for
Planning and Evaluation
National Library of Medicine
8600 Rockville Pike
Bethesda, Maryland 20894

Dear Dr. Siegel:

I will be pleased to participate in the National Library of Medicine's study of health professionals' use of MEDLINE. I authorize you to keep a record of my MEDLINE searches for possible discussion during the interview. During the weeks of [Dates], the most convenient time(s) to phone me on one or more of the following days would be:

[NOTE: PLEASE STATE TIMES ACCORDING TO YOUR OWN TIME ZONE]

(Circle one)

Mon., [Date], 1989 between ___ and ___ at phone #(____)______ EST CST MST PST
Tue., [Date], 1989 between ___ and ___ at phone #(____)______
Wed., [Date], 1989 between ___ and ___ at phone #(____)______
Thu., [Date], 1989 between ___ and ___ at phone #(____)______
Fri., [Date], 1989 between ___ and ___ at phone #(____)______

Mon., [Date], 1989 between ___ and ___ at phone #(____)______
Tue., [Date], 1989 between ___ and ___ at phone #(____)______
Wed., [Date], 1989 between ___ and ___ at phone #(____)______
Thu., [Date], 1989 between ___ and ___ at phone #(____)______
Fri., [Date], 1989 between ___ and ___ at phone #(____)______

___ I regret that I will be unavailable for an interview at this time, but I will be available during the week(s) of __________. Please contact me at (phone #) (____)__________ to schedule an interview during this time.

AIR I.D.
Name
Address
Address
Address

A-7
APPENDIX B
CRITICAL INCIDENT REPORT FORMS
Hello. This is __________________ calling for the National Library of Medicine. I'm calling to interview you for the Library's study of MEDLINE usage. Your response form indicated that this would be a good time. Can we proceed? [If yes,] Thank you. [If no, reschedule.]

We're especially interested in talking to professionals who do their own literature searches. Does this describe your use of MEDLINE? And I'm primarily interested in searches you have done on the NLM system, that is, direct searches using the ELHILL command language or searches done through Grateful Med. [Probe to make sure this is understood.]

It would help us write up the interview if we could tape record this conversation. Is that all right with you? [If yes, begin tape here.] Thanks. We'll erase the tape after we write up the interview.

I'm interested in recent MEDLINE searches that were especially helpful in your work or that were unsatisfactory. [For MD's, DDS's, RN's] I'm especially interested in searches that have had an impact on patient care.

I'm going to ask you a series of questions about such searches, one search at a time. I want to know what circumstance led you to do the search—what the context was, what specific question or issue you had in mind, what information you wanted and why. I'll need you to be as specific as you can. If I don't understand the situation or certain terminology, I'll ask you to explain it further.

I also will want to know how you did the search, as nearly as you can recall, and what information you got.

And I need to know how the information affected your thinking, what you did as a result of having the information, and what the end result was—for the patient or the situation.

When we've finished discussing specific searches, I'll need some information about the type of work you do. [Go to EFFECTIVE INCIDENT form.]
EFFECTIVE INCIDENT REPORT FORM

Can you think of a recent instance in which the information you obtained through a MEDLINE search you conducted was especially helpful with your work? Do you have a specific search in mind?

What was the situation that led you to do this search? [What problem arose? Why did you need information?]

What specific information were you seeking? [What was the subject of the search? What was the question that was in your mind (or in the mind of the person stimulating the search)?]

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? [Did you consult any of these other sources?]

How did you carry out this search to get the information you needed? [Did you use MeSH? Text words? Backfiles? Boolean operators? Limiters? Was search modified based on search results?]

What information did you obtain as a result of this search?

In what specific ways was this information helpful in your decision making? [What did you do (differently) as a result of what you learned?]

What was the impact on the situation of having this information? [How did it affect what happened? What might have happened otherwise?]

What was the outcome of the situation? [If applicable] What happened to the patient? What is the patient’s status or prognosis?

Draft, 1/6/89
1. How long ago did the search occur?
- [ ] Within the past week
- [ ] Within the past month (>1 wk)
- [ ] Within the past 3 months (>1 mo)
- [ ] Within the past 6 months (>3 mos)
- [ ] Within the past year (>6 mos)
- [ ] More than 1 year (specify)

2. What was the setting in which the need for information arose?
- [ ] Clinical care
- [ ] Research

3. Where was the search performed?
- [ ] Own home
- [ ] Own office
- [ ] Medical school library
- [ ] Hospital library
- [ ] Other (specify)

4. Were MeSH headings used?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]

5. Were Boolean operators used?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]

6. Was the search iterative?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]

7. Were qualifiers used?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]

8. When you obtained the citations, did you request the abstracts?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]
- [ ] N/A [-9]

9. Did the abstracts provide sufficient information for your needs?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]
- [N/A [-9]

10. Did you (or the person who needed the information) subsequently look at any of the articles?
- [ ] Yes [-1]
- [ ] No [-2]
- [ ] Don’t know [-7]
- [N/A [-9]

11. If [No] Why was this?
- [ ] None of the articles looked useful
- [ ] Articles had enough information
- [ ] Too difficult to obtain articles
- [ ] No time to obtain articles
- [ ] Not requested (did search for someone else)
- [ ] Immediate need
- [ ] Other (specify)

12. What system did you use to access MEDLINE?
- [ ] Direct access, command language
- [ ] Grateful Med, command language
- [ ] Grateful Med, form screen/menus
- [ ] Other (specify)
- [ ] Don’t know

13. If Grateful Med was used Which version of Grateful Med did you use in this search?
- [ ] #1 (3/85)
- [ ] #2 (3/87)
- [ ] #3 (1/88)
- [ ] Other (specify)

14. Have you always accessed MEDLINE in this way (system indicated in 12)?
- [ ] Yes [-1]
- [ ] No [-2]

15. If [No] What did you use before?
- [ ] Mediated search
- [ ] Grateful Med, menus
- [ ] Grateful Med, command language
- [ ] Direct access, command language
- [ ] Other (specify)

16. How long have you been performing MEDLINE searches yourself?
- [ ] <3 months
- [ ] 3-6 months
- [ ] 6 mos-1 year
- [ ] >1 year

17. How many MEDLINE searches have you done yourself?
- [ ] 1-10
- [ ] 11-20
- [ ] 21-50
- [ ] >50
- [ ] More than 10 (specify)

18. How many searches do you do in a typical month?
- [ ] <1
- [ ] 1-3
- [ ] 4-10
- [ ] >10
- [ ] More than 10 (specify)

19. How did you learn to search MEDLINE?
- [ ] Self-taught
- [ ] NLM 6-hour basic MEDLINE class
- [ ] NLM 3-5 day MEDLINE class
- [ ] Friend/colleague
- [ ] Other (specify sponsor and length)

20. What is the highest educational degree you have obtained?
- [ ] M.D. (specify specialty)
- [ ] M.D. and Ph.D. (specify M.D. specialty)
- [ ] D.D.S.
- [ ] R.N., L.V.N., L.P.N.
- [ ] Ph.D. (specify discipline)
- [ ] Other (specify)

21. What percent of your time is spent in the following professional activities?
- [ ] Patient care
- [ ] Teaching
- [ ] Research
- [ ] Administration

22. What percent of your time is spent in the following work settings?
- [ ] Self-employed/practice
- [ ] Group practice/partnership
- [ ] HMO
- [ ] Medical school
- [ ] Hospital
- [ ] Government agency
- [ ] Independent consulting
- [ ] Other (specify)

23. What size community do you work in (does your practice/hospital serve)?
- [ ] Non-metro <5,000 population
- [ ] Non-metro 5K-9,999
- [ ] Non-metro 10K-24,999
- [ ] Non-metro 25K-49,999
- [ ] Non-metro 50+ K
- [ ] SMSA <100K
- [ ] SMSA 100K-249,999
- [ ] SMSA 250K-499,999
- [ ] SMSA 500K-999,999
- [ ] SMSA 1+ million

24. Date of data collection:

25. Location of respondent (specify)

26. Location of interviewer:
- [ ] CNLM
- [ ] QAIR Palo Alto
- [ ] QAIR UCLA sample
- [ ] QU Tex

[117-1] QSend user
[118-1] QEffective
[118-2] QIneffective

Draft, 1/26/89
INEFFECTIVE INCIDENT REPORT FORM

Have you had any recent experience in which you performed a MEDLINE search that was unsatisfactory or not helpful in getting information that you needed for your work?

What was the situation that led you to do this search? [What problem arose? Why did you need information?]

What specific information were you seeking? [What was the subject of the search? What was the question that was in your mind (or in the mind of the person stimulating the search)?]

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? [Did you consult any of these other sources?]

How did you carry out this search to get the information you needed? [Did you use MeSH? Text words? Backfiles? Boolean operators? Limiters? Was search modified based on search results?]

What information did you obtain as a result of this search?

In what way was the search or its results unsatisfactory?

What search results would have been more helpful in your decision-making? [What might you have done differently if you had had the information you wanted?]

What was the impact on the situation of not having the information? [How did it affect what happened?]

What was the outcome of the situation? [(If applicable) What happened to the patient? What is the patient’s status or prognosis?]
1. How long ago did the search occur? [117]

2. What was the setting in which the need for information arose? [117]
   - [12-1] Own patient [12-2] Other MD's patient [12-3] Type of patient (not an individual) [12-4] Care setting:
     - [13-1] Office [13-2] Hospital—Inpatient (service:
       - [13-3] Hospital—Outpatient (service:

3. Where was the search performed? [117]

4. Were MeSH headings used? [117]
   - [27] Yes [+1] No [-2] Don't know [-7]

5. Were Boolean operators used? [117]

6. Was the search iterative? [117]
   - [29] Yes [+1] No [-2] Don't know [-7]

7. Were qualifiers used? [117]

8. When you obtained the citations, did you request the abstracts? [117]

9. Did the abstracts provide sufficient information for your needs? [117]

10. Did you (or the person who needed the information) subsequently look at any of the articles? [117]

11. If [No] Why was this? [117]
    - [34-1] None of the articles looked useful [34-2] Abstracts had enough information [34-3] Too difficult to obtain articles [34-4] No time to obtain articles [34-5] Not requested (did search for someone else) [34-6] No immediate need [34-7] Other [specify] [34-8] Other (specify)

12. What system did you use to access MEDLINE? [117]

13. If [Grateful Med was used] Which version of Grateful Med did you use in this search? [117]
    - [40] #1 (8/86) [-1] #2 (8/87) [-2] [40] #3 (1/88) [-3] #4 (12/88) [-4] Don’t know [-5]

14. Have you always accessed MEDLINE in this way? (systems indicated in 17?) [117]
    - [41] Yes [+1] No [-2]

15. If [No] What did you use before? [117]

16. How long have you been performing MEDLINE searches yourself? [117]

17. How many MEDLINE searches have you done yourself? [117]

18. How many searches do you do in a typical month? [117]

19. How did you learn to search MEDLINE? [117]
    - [54] Self-taught [55] QNLM 6-hour basic MEDLINE class [56] QNLM 3-day MEDLINE class [57] QGentle Med class [58] QFriend/colleague [59] Other (specify sponsor and length)

20. What is the highest educational degree you have obtained? [117]

21. What percent of your time is spent in the following professional activities? [117]

22. What percent of your time is spent in the following work settings? [117]

23. What size community do you work in (does your practice/hospital serve)? [117]

24. Date of data collection: __/__/___ [117]

25. Location of respondent (specify)

26. Location of interviewer:
Mediated user

Hello. This is ____________ calling for the National Library of Medicine. I'm calling to interview you for the Library's study of MEDLINE usage. Your response form indicated that this would be a good time. Can we proceed? [If yes,] Thank you. [If no, reschedule.]

We're especially interested in talking to professionals who have searches done on the NLM system, that is, direct searches using the ELHILL command language or searches done through Grateful Med. Does this describe your use of MEDLINE?

It would help us write up the interview if we could tape record this conversation. Is that all right with you? [If yes, begin tape here.] Thanks. We'll erase the tape after we write up the interview.

I'm interested in recent MEDLINE searches that were especially helpful in your work or that were unsatisfactory. [For MD's, DDS's, RN's] I'm especially interested in searches that have had an impact on patient care.

I'm going to ask you a series of questions about such searches, one search at a time. I want to know what circumstance led you to have the search conducted—what the context was, what specific question or issue you had in mind, what information you wanted and why. I'll need you to be as specific as you can. If I don't understand the situation or certain terminology, I'll ask you to explain it further.

I also will want to know how the search was done, as best you know, and what information you got.

And I need to know how the information affected your thinking, what you did as a result of having the information, and what the end result was—for the patient or the situation.

When we've finished discussing specific searches, I'll need some information about the type of work you do. [Go to EFFECTIVE INCIDENT form.]
EFFECTIVE INCIDENT REPORT FORM

Can you think of a recent instance in which the information you obtained through a MEDLINE search that was conducted for you was especially helpful with your work? Do you have a specific search in mind?

What was the situation that led to your need for this search? [What problem arose? Why did you need information?]

What specific information were you seeking? [What was the subject of the search? What was the question that was in your mind?]

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? [Did you consult any of these other sources?]

How did you explain your information need to the person carrying out the search?

How was this search carried out to get the information you needed? [Did the searcher use MeSH? Text words? Backfiles? Boolean operators? Limiters? Was search modified based on search results?]

What information did you obtain as a result of this search?

In what specific ways was this information helpful in your decision making? [What did you do (differently) as a result of what you learned?]

What was the impact on the situation of having this information? [How did it affect what happened? What might have happened otherwise?]

What was the outcome of the situation? [(If applicable)What happened to the patient? What is the patient’s status or prognosis?]
1. How long ago did the search occur?  
[1-9] [Within past 2 weeks]  
[9-30] [Within past month]  
[30-90] [Within past 3 months]  
[90-365] [Within past 6 months]  
[365-529] [Within past year]  
[529+] [More than 1 year]  

2. What was the setting in which the need for information arose?  
[1] [Clinical Care]  
[2] [Research]  
[3] [Teaching]  

3. Where was the search performed?  
[1] [Home]  
[2] [Office]  
[3] [Library]  

4. Who performed the search for you?  
[1] [Medical librarian]  
[2] [Librarian]  
[3] [Research assistant]  
[4] [Clinical assistant]  
[5] [Other]  

5. What was the search strategy?  
[1] [Boolean operators]  
[2] [Keywords]  

6. Was the search iterative?  
[1] [Yes]  
[2] [No]  

7. Was the search comprehensive?  
[1] [Yes]  
[2] [No]  

8. When you obtained the citations, did you request the abstracts?  
[1] [Yes]  
[2] [No]  

9. Did the abstracts provide sufficient information for your needs?  
[1] [Yes]  
[2] [No]  

10. Did you subsequently look at any of the articles?  
[1] [Yes]  
[2] [No]  

11. [If No] Why was this?  
[1] [None of the articles looked useful]  
[2] [Abstracts had enough information]  
[3] [Too difficult to obtain articles]  
[4] [No time to obtain articles]  
[5] [Not requested (did search for someone else)]  

12. What system was used to access MEDLINE?  
[1] [Direct access, command language]  
[2] [Graphical, command language]  
[3] [Graphical, form screen/menu]  
[4] [Other]  

13. [If Grateful Med was used] Which version of Grateful Med was used in this search?  
[1] [1/365]  
[2] [3/367]  
[3] [1/88]  
[4] [12/88]  

14. How did you communicate the requirements of your search to the person who performed the search?  
[1] [Direct discussions with search]  
[2] [Fulfilled search request form]  
[3] [Other]  

15. Were you present when the search was performed?  
[1] [Yes]  
[2] [No]  

16. How long have you been requesting MEDLINE searches?  
[1] [<3 months]  
[2] [3-6 months]  
[3] [6-12 months]  
[4] [1 year]  

17. How many MEDLINE searches have you requested?  
[1] [1-10]  
[2] [11-20]  
[3] [21-50]  
[4] [51-100]  
[5] [More than 100]  

18. How many searches do you request in a typical month?  
[1] [1-3]  
[2] [4-10]  
[3] [More than 10]  

19. [Blank]  

20. What is the highest educational degree you have obtained?  
[1] [Medical degree (specify specialty)]  
[2] [M.D. and Ph.D. (specify M.D. specialty)]  
[3] [D.D.S.]  
[4] [G.R.N., L.V.N./L.P.N.]  
[5] [Ph.D. (specify discipline)]  

21. What percent of your time is spent in the following professional activities?  
[1] [Patient care]  
[2] [Teaching]  
[3] [Research]  
[4] [Administration]  

22. What percent of your time is spent in the following work settings?  
[1] [Self-employed/solo practice]  
[2] [Group practice/partnership]  
[3] [HMO]  
[4] [Medical school]  
[5] [Hospital]  
[6] [Government agency]  
[7] [Independent consulting]  

23. What size community do you work in?  
[1] [Non-metro <5,000 population]  
[2] [Non-metro 5K-9,999]  
[3] [Non-metro 10K-24,999]  
[4] [Non-metro 25K-49,999]  
[5] [Non-metro 50K-99,999]  
[6] [Non-metro 100K-999,999]  
[7] [Non-metro 1,000,000+ population]  

24. Date of data collection: __/__/__  

25. Location of respondent (specify)  

26. Location of interviewer:  
[1] [QNL]  
[2] [AIR Palo Alto]  
[3] [AIR UCLA sample]  
[4] [U Tex]  

7) [Transaction log of particular interest]  

117) [Mediated user]  

118) [Effective]  

119) [Ineffective]  

[Draft, 1/26/89]
INEFFECTIVE INCIDENT REPORT FORM

Have you had any recent experience in which a MEDLINE search that was performed for you was unsatisfactory or not helpful in getting information that you needed for your work?

What was the situation that led to your need for this search? [What problem arose? Why did you need information?]

What specific information were you seeking? [What was the subject of the search? What was the question that was in your mind?]

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? [Did you consult any of these other sources?]

How did you explain your information need to the person carrying out the search?

How was this search carried out to get the information you needed? [Did the searcher use MeSH? Text words? Backfiles? Boolean operators? Limiters? Was search modified based on search results?]

What information did you obtain as a result of this search?

In what way was the search or its results unsatisfactory?

What search results would have been more helpful in your decision-making? [What might you have done differently if you had had the information you wanted?]

What was the impact on the situation of not having the information? [How did it affect what happened?]?

What was the outcome of the situation? [(If applicable) What happened to the patient? What is the patient's status or prognosis?]

Draft, 1/27/89
Mediated User

20. What is the highest educational degree you have obtained?
   [61-1] M.D. (specify specialty)
   [61-2] M.D. and Ph.D. (specify M.D.
   specialty)
   [61-3] D.D.S.
   [61-5] Ph.D. (specify discipline)
   [61-6] Other (specify)

21. What percent of your time is spent in the following professional activities?
   [63-67] % Patient care
   [69-71] % Teaching
   [72-74] % Research
   [75-77] % Administration
   [78-80] % Other (specify)

22. What percent of your time is spent in the following work settings?
   [83-85] % Self-employed/solo practice
   [86-88] % Group practice/partnership
   [89-91] % HMO
   [92-94] % Medical school
   [95-97] % Hospital
   [98-100] % Government agency
   [101-103] % Independent consulting
   [104-106] % Other (specify)

23. What size community do you work in (does your practice/hospital serve)?
   [109-111] Non-metro <5,000 population
   [109-2] Non-metro 5K-9,999
   [109-5] Non-metro 50+ K
   [109-6] SMSA 100K
   [109-7] SMSA 100K-249,999
   [109-8] SMSA 250K-499,999
   [109-9] SMSA 500K-999,999
   [109-10] SMSA 1+ million

24. Date of data collection: __/__/____ [110/115]

25. Location of respondent (specify)

26. Location of interviewer:
   [116-1] INLM
   [116-2] AIR Palo Alto
   [116-3] AIR UCLA sample
   [116-4] IU Text

[117] Number of citations log of particular interest

8. When you obtained the citations, did you request the abstracts?
   [31] Yes [-1] No [-2] Don’t know [-7]
   [NA] [-9]

9. Did the abstracts provide sufficient information for your needs?

10. Did you subsequently look at any of the articles?

11. Why was this?
    [34] None of the articles looked useful
    [35] Articles had enough information
    [36] Too difficult to obtain articles
    [37] No time to obtain articles
    [38] Not requested (did search for someone else)
    [39] No immediate need
    [40] Other (specify)___

12. What system was used to access MEDLINE?
    [37] Direct access, command language
    [38] Grateful Med, command language
    [40] Other (specify)___

13. Which version of Grateful Med was used in this search?
    [40] #1 (3/65) [3-7] #2 (3/67) [1-2]
    [39] #3 (1/88) [3-7] #4 (12/88) [4-7]
    [40] Don’t know [-7]

14. How did you communicate the request of your search to the person who performed the search?
    [45] Direct discussions with researcher
    [46] Filled out search request form
    [47] Other (specify)___

15. Were you present when the search was performed?
    [48] Yes [-1] No [-2]

16. How long have you been requesting MEDLINE searches?
    [49] <3 months [-1] 3-6 months [-2]
    [6-9 months] [1-2] 1 year [-3] [1-2]

17. How many MEDLINE searches have you requested?
    [50] 1-10 [-1] 11-20 [-2]
    [100+] [5-7]

18. How many searches do you request in a typical month?
    [51] <1 [-1] 1-3 [-2] 4-10 [-3]
    [10+] [4-7]

27. Were MeSH headings used?
    [27] Yes [-1] No [-2] Don’t know [-7]

28. Were Boolean operators used?
    [28] Yes [-1] No [-2] Don’t know [-7]

29. Was the search intrusive?
    [29] Yes [-1] No [-2] Don’t know [-7]

30. Were qualifiers used?

[117-2] Mediated user
[118-1] Effective
[118-2] Ineffective

Draft, 1/26/89
APPENDIX C

INCIDENTS AND TRANSCRIPTIONS
Transcript of Interview with an End User (#0452)

INTERVIEWER: I'm going to be asking you a series of questions about searches that you've done, one search at a time. So if you could think of a recent instance in which the information you obtained through a MEDLINE search you conducted was especially helpful in your work. Can you think of a specific search?

RESPONDENT: Um, as you get older you can't remember. I think I did one on strep throat.

INTERVIEWER: OK.

RESPONDENT: Streptococcal Group A beta-hemoglobin infection.

INTERVIEWER: What was the situation that led you to do this search?

RESPONDENT: Um, I'm the maternal and child health coordinator and the head of pediatrics here at the [Name] Hospital in [City]. And I had to revise the old policy and procedure for managing strep infection. Is that confusing?

INTERVIEWER: No, no, not at all. So, you were revising your procedure for strep...

RESPONDENT: Yes. Procedure for the clinical management of strep throats.

INTERVIEWER: And what was the old policy that needed changing?

RESPONDENT: Um, the policy isn't--hasn't changed much, actually, but I just wanted to make the medical staff and the nursing staff aware of some of the newer findings, the newer information about strep throat.

INTERVIEWER: And when you went to do the search, what was the specific information you were searching, the question you had in your mind?

RESPONDENT: There were a number of them. One of them was the proper antibiotic treatment, the second thing was whether or not non-Group A strep infection had to be treated as vigorously, the third thing was whether we should treat promptly or wait till the culture comes back--do you want me to list all of them?

INTERVIEWER: Sure, I'm getting them.

RESPONDENT: Another one, the fourth one, would be what you do with the carrier state, or those who are repeatedly positive. I think those were the main issues that we wanted to clarify.
INTERVIEWER: And you were interested in the Group A strep?


INTERVIEWER: And how does that differ from the non-Group A?

RESPONDENT: Well, the non-Group A are usually things like Group C, which can cause family outbreaks, but don't cause rheumatic fever. Group A strep causes rheumatic fever if it's untreated, which the other groups don't.

INTERVIEWER: OK, so the other one is less possibly dangerous.

RESPONDENT: Yes, that would be correct.

INTERVIEWER: OK. And why did you choose to do a MEDLINE search instead of consulting some other source like textbooks or journals or colleagues?

RESPONDENT: Well, I did consult—well, I'm the expert here, so there's no colleagues—actually I did, I consulted one of the internists who is an infectious disease person. The textbooks are four years out of date, I did consult textbooks. I did consult the Red Book, which is only a year old, which is a good source. But I wanted to read some of the literature myself and I find that if I go to the nearby university, there's a lag time of, you know, a week or so, and then they charge us much more money than it would cost if I did the search myself.

INTERVIEWER: OK. And how did you go about carrying out the search? You said you used Grateful Med, and then did you use MeSH headings or textwords?

RESPONDENT: I used textwords. I'm in the process of getting the new revised brochure about how to use MEDLINE so I can use the MeSH better, but I just used the text and I ended up fumbling around, you know, I have to do a couple of searches because I don't do it right. In other words, you know, I put it in, I used regular text, and then it's too broad a category, too narrow a category, and then I gotta redo it—but I'm learning.

INTERVIEWER: And do you remember what the textwords were that you used?

RESPONDENT: I think I finally came down to searching under "streptococcal diseases."

INTERVIEWER: And did you use "streptococcal disease" AND anything OR anything?
RESPONDENT: I don't think so. I think what I did--I had trouble, if I used Group A beta hemolytic strep it didn't work, I seem to have a little trouble, and I probably wasn't searching correctly.

INTERVIEWER: OK. So you found the best way to do it with just "streptococcal disease" alone.

RESPONDENT: Correct.

INTERVIEWER: Did you search backfiles?

RESPONDENT: No.

INTERVIEWER: And did you--

RESPONDENT: I would have searched backfiles except that--and I've spoken to the people who made Gmteful Med before--is that the old version, Version 3, I think, wouldn't run on my IBM--not clone, but my IBM computer--and a whole bunch of other people I know IBM computer--I wrote in and they gave me some kind of a quick fix but it never seemed to work, so I ended up using the old Version 2 or something where to do backfiles it was difficult 'cause it didn't have the right program in it, so with the new Version 4, I should be able to do more backfile searching.

INTERVIEWER: Mm-hmm. And did you use any kind of limiters, like "English only" or "reviews only"?

RESPONDENT: Yes. I used--I first used--I always use "English only" but--because those are the ones I'm more interested in, and it's easier, because I can't translate 'em or anything. But I think I did "reviews only" then I did one without a review. I did the "reviews only" first and then I did another one without the reviews.

INTERVIEWER: OK. And what was the information that you obtained as a result of the search?

RESPONDENT: Well, it answered all my questions! I know it sounds like a testimonial, but it did. You know, I found out about Group C, I found out about chronic carriers and this and that--there were a whole bunch of real good articles. Some of which I actually had, and it reminded me to go look in my own files for copies.

INTERVIEWER: And can you remember any of the specific information, like what did it say about proper antibiotic treatment...

RESPONDENT: Well, sure, I mean--it said basically--well, lemme just give you the things that I found that we were doing that wasn't right.
INTERVIEWER: OK. That would be great.

RESPONDENT: Number one, as we were using Bicillin CR, which is a long and short acting combination, when we probably should have been using almost all Bicillin LA and only Bicillin CR if the kid's under 12. Number two, the treatment of the carrier state for recurrences using Cephalosporin and also Rifampin was relatively new knowledge. The fact that you cannot predict the presence or absence of Group A strep infections from the number of colonies—we used to think that if you had a few colonies it was a carrier, if there was a lot of colonies you had an active disease—you can't tell. And, let me see what else—the other thing was the Group C thing, that being the cause of rheumatic fever, but just as it being treatable, in the sense that you can get a strep throat, but you won't get rheumatic fever from it. There were a few other minor things, but those were the bigger things, I think, that came out of it.

INTERVIEWER: In what specific ways was the information helpful in your decision-making. What did you do with the results of what you got?

RESPONDENT: Well--I rewrote the policy. You know, I wrote a--what I did now, is I wrote a, like a fact sheet that'll give the kind of a like a summary of recent and old clinical findings that are significant for people to know, indications for throat culture and treatment. See, one of the reasons why we're doing this is we thought we were taking too many throat cultures. And it turns out we're probably not taking too many throat cultures. And that I found out too, but I knew that before, actually. Um, that you have to have a certain percentage of negatives—you can't, in other words if you have—if you do throat cultures on school kids like we do here, and you have 90% of them positive, you aren't taking enough throat cultures. You're being too selective. You need to have a probably like a 25 or 30 percent, you know, positive, and you have to have like 75 percent negative, otherwise you're not—you're being too selective.

INTERVIEWER: So that anything that remotely looks like it might be strep you culture.

RESPONDENT: Well, I wouldn't say remotely, but we establish criteria for when you would culture a throat, and I wrote it down, you know, in a very simple way, so that the nurses and the doctors and non-pediatricians and the nurse practitioners and everyone can follow it. So we established guidelines that were medically correct but simple. We didn't go into these long-winded algorithms, I made it very simple so that anyone can pick it up and just say "Aha! Sudden onset of a fever of 102, bad sore throat, pus on the tonsils, swollen glands, exposed to strep, past history of
rheumatic fever--treat," rather than get into a long-winded philosophical discussion, which clinically you can't function that way. People just don't make those decisions.

**INTERVIEWER:** Mm-hmm. So it was like sudden onset of fever, presence of pus on the tonsils, red throat--

**RESPONDENT:** --swollen glands, what's called an enanthem, or petechiae on the soft palate, recent exposure to strep, past history of rheumatic fever, would be reasons to treat.

**INTERVIEWER:** OK. And--

**RESPONDENT:** You could take a culture I mean and treat, and not wait for the culture to come back.

**INTERVIEWER:** OK.

**RESPONDENT:** Or "treat before culture is returned."

**INTERVIEWER:** And what was the impact on the situation of having the information?

**RESPONDENT:** I can't tell you that, because I have to give the inservice, and we have--I mean, this, a little, we just finished it like a week ago. I feel good about the policy because it's not much different than the old policy, to be honest with you. The old policy was also very practical, and the old policy has stood the test of time, in the sense that not much has come up to change. We've changed some of the treatments and the understanding of it from doing a search like this but the management of it really hasn't changed a heck of a lot. It's the same thing that I established four years ago.

**INTERVIEWER:** And what do you think might have happened if you didn't do the MEDLINE search?

**RESPONDENT:** Well, we would have fumbled around again with the same old policy, and people would have been acting on misinformation and lack of information. I think this way it's clarified that I feel as the head of maternal and child health policies and procedures here, I feel comfortable in that this is a reasonably good policy. And as long as I feel comfortable, then I can tell people to carry it out.

**INTERVIEWER:** And what do you think the outcome of this situation will be? What do you think will happen to the patients?

**RESPONDENT:** Well, I think they're going to get better care, although they got good care before, but I think the care will be improved in the sense that all of us will have a better idea, there'll be a consistent approach instead of one provider saying this and one provider saying that, I think the nurses will feel
more comfortable knowing that there's a consistent policy, they don't have to go up to three doctors to find out what to do, and I think if we are--which we're not planning on, but we are going to do any kind of a clinical review or a QA thing--quality assurance, of how we're treating sore throats, at least we've got the beginnings of 1) a policy and procedure, and 2) we can follow these people. So it kinda tidies up the whole thing. It's a common illness we see in the outpatient department, plus we have it in school, the kids nearby.

INTERVIEWER: Especially at this time of year.
RESPONDENT: Yeah.
INTERVIEWER: Uh, how long ago did you do the search?
RESPONDENT: I can't recall exactly, I'd say 3 weeks ago.
INTERVIEWER: So it's certainly within the last month.
RESPONDENT: Oh, yeah, it's in the past month.
INTERVIEWER: And you'd say this would be for a type of patient? or would you call it for administration?
RESPONDENT: It would be both. It was an administrative need, to establish the policy and procedure, and also is for specific patients' illness.
INTERVIEWER: Right. And where was the search performed?
RESPONDENT: You mean in [City], [State]?
INTERVIEWER: No, no, did you do it in your home or your office?
RESPONDENT: I did it in the office.
INTERVIEWER: OK. When you obtained the citations, did you request the abstracts online?
RESPONDENT: Yes.
INTERVIEWER: OK. And did you then go and look at the articles themselves?
RESPONDENT: Umm, in the articles that I had, I was surprised that I could find actually a fair number of them here, yes.
INTERVIEWER: OK. And you used Grateful Med the form screens?
RESPONDENT: Form screens...
INTERVIEWER: As opposed to using command language.
RESPONDENT: No, I used the forms screens.

INTERVIEWER: OK. And do you know what version of Grateful Med you used?

RESPONDENT: Uh, I think it was 2...It actually may have been the latest one, 4, I'm not sure whether I had put that one on yet. It was either 2 or 4. Actually, it was 4.

INTERVIEWER: OK. And have you always accessed MEDLINE this way? Using Grateful Med?

RESPONDENT: No. In the beginning, years ago, I used Knowledge Index.

INTERVIEWER: What is Knowledge Index?

RESPONDENT: It's a DIALOG--

INTERVIEWER: Oh, it's using DIALOG.

RESPONDENT: It's a DIALOG, and then you get into using Knowledge Index which is a version of it made for--it's easier to use. But I haven't used that--since Grateful Med came along, that's all I've been using.

INTERVIEWER: And it sounds like you have done mediated searches where you've gone to the library and had them search for you.

RESPONDENT: Yes.

* * *

[Interview continued with second incident report]

INTERVIEWER: OK. Can you think of another situation in which you found MEDLINE either very helpful for your work or alternatively where you had a lot of problems and you found it was not helpful?

RESPONDENT: Uh, well, someone asked me to look up, I think, some blood disorder.

INTERVIEWER: Was this effective or ineffective?

RESPONDENT: Well, it turned out to be ineffective, and I think that the reason was again, that I didn't sit down and--she came into the office and wanted it done quickly. Usually I sit down and go over the thing, and I--I forget the word you folks used, but I kinda designed the search, kinda did it quickly and it I got like no responses or 5,000. It was either un--it was either zero or overloaded. I didn't design the search properly.
INTERVIEWER: What was the situation that led to the search—somebody on the staff asked you for some information on blood?

RESPONDENT: She came up and says, We have a patient with this thing, can you look it up for me?

INTERVIEWER: Do you remember what the thing was?

RESPONDENT: It was thrombocytopenia, I think. And I don’t know why—it’s a relatively simple search, I don’t know why I couldn’t—I think I must have in a hurry typed it in wrong.

INTERVIEWER: So the patient had thrombocytopenia. And why did they need to get—what was it—

RESPONDENT: I think they just wanted to get some of the latest literature—’cause the textbooks are usually behind the times. I mean that’s the main—that’s why I like this—

INTERVIEWER: And do you know what the question was that the person was asking?

RESPONDENT: No. It was just that she wanted to get the latest information on it.

INTERVIEWER: What would be the symptoms of thrombocytopenia or what would—

RESPONDENT: Bleeding tendency.

INTERVIEWER: OK, so they present a bleeding tendency and the doctor wanted the latest information on what—diagnosis, treatment—

RESPONDENT: Correct.

INTERVIEWER: And the textbooks were out of date.

RESPONDENT: ...I’m going to have to beg off, because I have to make rounds.

INTERVIEWER: OK, let me just ask you a quick series of questions and then we’ll be done. How long have you been searching MEDLINE yourself?

RESPONDENT: Whenever Version 2 came out, I would say 3 years.

INTERVIEWER: And how many MEDLINE searches do you do yourself—have you done yourself? 11-20, 21-50—

RESPONDENT: I’d say 11-20.

INTERVIEWER: OK. And how many do you do in a typical month?
RESPONDENT: Oh, I probably do one every other month.

INTERVIEWER: And you were self-taught, or did you take a class?

RESPONDENT: Self-taught, like everything else.

INTERVIEWER: And you have an MD, or an MD/PhD?

RESPONDENT: MD.

INTERVIEWER: In what specialty?

RESPONDENT: P Ed.

INTERVIEWER: And what percent of your time do you spend in patient care, teaching, research, administration--

RESPONDENT: 100%.

INTERVIEWER: 100% in patient care?

RESPONDENT: Oh, you want to know how much in each one?

INTERVIEWER: Yeah.

RESPONDENT: Oh, I probably spend 80% in patient care and 20% in running programs. I work for [Government Agency]--we do public health, so there's a fair amount of administration. I don't mean that I supervise anyone, or--I supervise some people--but I end up designing policies and procedures and--meetings--and stuff like that.

INTERVIEWER: And so you say you're 100% with a government agency.

RESPONDENT: Yes ma'am.

INTERVIEWER: And how large a community does your practice hospital serve?

RESPONDENT: Uh, about 20,000 [Population Group].

INTERVIEWER: OK. Well, thank you very much for your help. Bye-bye.
Incident # 01-0452-01

Effective Incident Report Form--End User

What was the situation that led you to do this search? I needed to do a search on Group AB-hemolytic strep infection. I'm the head of maternal and child health at the [Name] Hospital. I had to revise the old policy and procedure for managing strep infections. I needed to make the medical and nursing staff more aware of the new information on strep throats. Group A causes rheumatic fever.

What specific information were you seeking? I needed proper antibiotic treatment. Whether non-Group A strep infections needed to be treated as vigorously. Whether to treat promptly or wait for cultures to come back. What to do with carrier state or those who are repeatedly positive.

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? I consulted one of the infectious disease people. Textbooks were 4 years out of date. I wanted to read the literature myself.

How did you carry out this search to get the information you needed? Grateful Med, textbooks-streptococcal disease. English only always, reviews-only at first.

What information did you obtain as a result of this search? It answered all my questions. I had been using Bicillin-CR, I should have used Bicillin-LA. Bicillin-CR should only be used for children under 12. The treatment for recurrence is cephalosporins and rifampin. You can't predict presence or absence of the disease by the number of colonies. If you have 90% positive cultures, you're being too selective about which patients you culture.

In what specific ways was this information helpful in your decision making? I rewrote policy. I wrote a fact sheet with a summary of recent and old clinical findings, the indications for throat cultures, treatment. It established criteria when to culture throat--sudden onset of 102-degree fever and pus on tonsils; a red throat, swollen glands, exposure to strep--and instructions to treat before culture.

What was the impact on the situation of having this information? I just finished preparing policy. Not much different from old policy. Without the search we would have fumbled with old policy and with lack of information. I feel comfortable this is a reasonably good policy.

What was the outcome of the situation? Patients will get better care. We will use a consistent approach. Nurses feel more comfortable, knowing there's a consistent policy. If we do QA audit we have beginnings of following people in a consistent way.

C-11
How long ago did the search occur?
☐ Within the past week
☐ Within the past month (>1 wk)
☐ Within the past 3 months (>1 mo)
☐ Within the past 6 months (>3 mos)
☐ Within the past year (>6 mos)
☐ More than 1 year (specify)

What was the setting in which the need for information arose?

Clinical Care
☐ Relationship to patient:
☐ Own patient
☐ Other MD's patient
☐ Type of patient (not an individual)
Care setting:
☐ Office
☐ Hospital—inpatient
☐ Hospital—outpatient
☐ Emergency room
☐ Other (specify)

Teaching
☐ Medical school (undergraduate)
☐ Graduate medical education
☐ Continuing education
☐ Other (specify)

Research
☐ Research planning
☐ Grant application
☐ Research in progress
☐ Paper, report, or presentation
☐ Other (specify)
☐ Administration
☐ Writing (not research or teaching)
☐ Professional presentation (not research or teaching)
☐ Personal learning
☐ Consulting (non-patient care)
☐ Other (specify)

Where was the search performed?
☐ Own home
☐ Own office
☐ Medical school library
☐ Hospital library
☐ Other (specify)

Were MeSH headings used?
☐ Yes [1] ☐ No [-2] ☐ Don't know [-7]

Were Boolean operators used?
☐ Yes [1] ☐ No [-2] ☐ Don't know [-7]

Was the search iterative?
☐ Yes [1] ☐ No [-2] ☐ Don't know [-7]

Were qualifiers used?
☐ Yes [1] ☐ No [-2] ☐ Don't know [-7]

When you obtained the citations, did you request the abstracts?
☐ Yes [1] ☐ No [-2] ☐ Don't know [-7] ☐ N/A [-9]

9. Did the abstracts provide sufficient information for your needs?

10. Did you (or the person who needed the information) subsequently look at any of the articles?
[33] ☐ Yes [-1] ☐ No [-2] ☐ Don't know [-7] ☐ N/A [-9]

11. If [No] Why was this?
[34-1] ☐ None of the articles looked useful
[34-2] ☐ Abstracts had enough information
[34-3] ☐ Too difficult to obtain articles
[34-4] ☐ No time to obtain articles
[34-5] ☐ Not requested (did search for someone else)
[34-6] ☐ No immediate need
[34-7] ☐ Other (specify)

12. What system did you use to access MEDLINE?
[37-1] ☐ Direct access, command language
[37-4] ☐ Other (specify)
[37-5] ☐ Don't know

13. If Grateful Med was used, which version of Grateful Med did you use in this search?
[40] ☐ #1 (3/86) [-1] ☐ #2 (3/87) [-2]
☐ #3 (1/88) [-3] ☐ #4 (12/88) [-4]
☐ Don't know [-5]

14. Have you always accessed MEDLINE in this way? (system indicated in 12?)
[41] ☐ Yes [-1] ☐ No [-2]

15. If [No] What did you use before?
[42-1] ☐ Mediated search
[42-4] ☐ Direct access, command language
[42-5] ☐ Other (specify)

Ask following questions once, after last incident:

16. How long have you been performing MEDLINE searches yourself?
[49] ☐ <3 months [-1] ☐ 3-6 months [-2]
☐ 6 mos-1 year [-3] ☐ >1 year [-4]

17. How many MEDLINE searches have you done yourself?
[50] ☐ 1-10 [-1] ☐ 11-20 [-2]
☐ 21-50 [-3] ☐ 51-100 [-4]
☐ More than 100 (specify) [-5]

18. How many searches do you do in a typical month?
[51] ☐ <1 [-1] ☐ 1-3 [-2] ☐ 4-10 [-3]
☐ More than 10 (specify) [-4]

20. What is the highest educational degree you have obtained?
[61-1] ☐ M.D. (specify specialty)
[61-3] ☐ D.D.S.
[61-5] ☐ Ph.D. (specify discipline)
[61-6] ☐ Other (specify)

21. What percent of your time is spent in the following professional activities?
[65-68] ☐ % Patient care
[69-71] ☐ % Teaching
[72-74] ☐ % Research
[75-77] ☐ % Administration
[78-80] ☐ % Other (specify)

22. What percent of your time is spent in the following work settings?
[83-85] ☐ % Self-employed/sole practice
[86-88] ☐ % Group practice/partnership
[89-91] ☐ % HMO
[92-94] ☐ % Medical school
[95-97] ☐ % Hospital
[98-100] ☐ % Government agency
[101-103] ☐ % Independent consulting
[104-106] ☐ % Other (specify)

23. What size community do you work in (does your practice/hospital serve)?
[109-1] ☐ Non-metro <5,000 population
[109-2] ☐ Non-metro 5K-9,999
[109-5] ☐ Non-metro 50+ K
[109-6] ☐ SMSA <100K
[109-7] ☐ SMSA 100K-249,999
[109-8] ☐ SMSA 250K-499,999
[109-9] ☐ SMSA 500K-999,999
[109-10] ☐ SMSA 1+ million

24. Date of data collection: 02/07/89

25. Location of respondent:
☐ (specify) (City, State)

26. Location of interviewers:
[116-1] ☐ NLM
[116-2] ☐ AIR Palo Alto
[116-3] ☐ AIR UCLA sample
[116-4] ☐ O Text
Transcript of Interview with a Mediated User (#U024)

INTERVIEWER: We are interested in recent MEDLINE searches that were especially helpful in your work or ones that were unsatisfactory. And we are also especially interested in searches that have had an impact on patient care. The way the interview is structured I am going to ask you a series of questions about searches that you have requested. I'd like you to describe them one at a time and the questions will relate to the circumstances that led you to do the search, how it was conducted (as best you know), the information you got, and how you are using the information. Can you think of a recent time when the information you got through MEDLINE search was especially helpful with your work?

RESPONDENT: OK, I'm just now making some notes down. I've done a few--uh--I'll try to remember them.

INTERVIEWER: Are these ones you did yourself or did you request them?

RESPONDENT: These are ones I requested of our librarian to do them. They didn't give you a list, did they? I have got three that I remember; I know I've done more than that. One was actually quite a while back--it was on Crohn's disease and nutrition and so on, and that was directly related to a patient.

INTERVIEWER: OK. What situation led to you this?

RESPONDENT: A patient who was very ill with Crohn's disease and had basically lost some weight and was on a very dangerous trail.

INTERVIEWER: And so what problem arose; why did you do the search?

RESPONDENT: Partly because I wasn't familiar with all the latest ways of managing the problem and the specific ways of dealing with the nutritional complication of Crohn's.

INTERVIEWER: So when you say the problem, you mean her weight loss?

RESPONDENT: She also had some various intestinal problems as well as depression.
INTERVIEWER: So you were interested in the search of all these various aspects—weight loss, depression, and the intestinal. Why did you chose to do a MEDLINE search in this case instead of consulting some other information source such as textbooks, colleagues, or your journal collection?

RESPONDENT: Mainly to try to find the latest information and also good review articles. I did look in the textbooks, too, but it doesn't really have the depth of information.

INTERVIEWER: OK. Were colleagues of any help?

RESPONDENT: Not a huge amount. Not with the kind of... I guess partly, too, I liked to get a base, I mean the general recommendation, but not the specific research that backs it up or the things that you can look back on later. I felt like I wanted that.

INTERVIEWER: OK. How did you explain your information?

RESPONDENT: I just got a call; either I could call you back or give me a call in about five minutes or so.

INTERVIEWER: Sure, I'll try back in five minutes.

INTERVIEWER: [Interview resumed] That search when you asked for it, how did you explain what you wanted to the librarian?

RESPONDENT: Oh, this again is going back a little. I think what I said was something about Crohn's and complication of nutrition, something like a conjunction of some of those.

INTERVIEWER: OK. Do you know how the search was carried out? Do you know much about that?

RESPONDENT: No, they just go ahead and do it. We get the printout which they used, I never look at that.

INTERVIEWER: Do you know how many years back they looked?

RESPONDENT: I'm not positive. I think in general they may have looked either three years or five years. Although I am not sure.

INTERVIEWER: And what information did you get from the search?
RESPONDENT: Basically, there were several good review articles and then I got some specific ones about nutritional work and I think one was about intestinal complications.

INTERVIEWER: In what specific ways was the information useful to you?

RESPONDENT: I see, I guess the main thing was the background information and thinking about ... interpretation of background and thinking about my patient. The specific things we used with her -- if this one wasn't so far back -- a lot of ... forgotten ... an individual patient ... a kind of general issue. But this particular one I know we went ahead and did Hyperal for a while, and I actually can't remember now.

INTERVIEWER: What does that mean?

RESPONDENT: It means having a central venous line into the chest that you can give sugar and fat solutions and proteins.

INTERVIEWER: So you don't know or remember if that was based on recommendations on the articles or--

RESPONDENT: No, I can't. I know that they discussed it some, but I really can't recall how much I got from the articles and how much I used in deciding...

INTERVIEWER: OK. How do you spell Hyperal?

RESPONDENT: H-Y-P-E-R-A-L.

INTERVIEWER: And what was the outcome for this patient?

RESPONDENT: It was good. She went home, gained weight, and actually got pregnant.

INTERVIEWER: And what is the prognosis for Crohn's disease?

RESPONDENT: With Crohn's it varies. There are some people who will kind of remit and they will not have much more problem and there are others who get very bad and eventually need lots of surgery and they die from it, and there are others who just kind of waxing and waning.

INTERVIEWER: Do you know what it was for this patient?
RESPONDENT: This patient still has active disease and she will probably eventually need surgery, but we did not have to do one. We felt we might have to at the time and it has now been over a year that we have avoided having to do it.

INTERVIEWER: OK. How long ago did you do this? When was this search done?

RESPONDENT: This search was—I believe it was early last year.

INTERVIEWER: And, was this your own patient?

RESPONDENT: Yes.

INTERVIEWER: What service? Was it inpatient?

RESPONDENT: It was medicine.

INTERVIEWER: Where was the search performed?

RESPONDENT: [Initials of medical center] and ...

INTERVIEWER: Who performed the search -- was it a medical librarian?

RESPONDENT: Yes.

INTERVIEWER: Did you ask for any abstracts when you got citations?

RESPONDENT: I didn't ask for the abstracts, I asked for actual articles, not citations. I got a list(?) of very brief titles and then I kind of chose from that.

INTERVIEWER: Do you know what system they used at ...?

RESPONDENT: No.

INTERVIEWER: Did you talk to the searcher, did you fill out a search request form, how did you--

RESPONDENT: What I usually do is talk and I write something down, it's not actually a question. I put something down.

INTERVIEWER: And were you present when the search was performed?

RESPONDENT: No.
INTERVIEWER: OK. I now have a few general questions about your experience with MEDLINE and your practice. How long have you been requesting MEDLINE searches?

RESPONDENT: When I was in medical school, I think I did one. But basically since I got to ... probably the second year in a row since I've been doing it--so that makes it a year-and-a-half now.

INTERVIEWER: Could you estimate how many MEDLINE searches you have requested total?

RESPONDENT: I think it's been about six or seven. I've currently remembered four that I have written down, but I think there were more.

INTERVIEWER: OK. How many searches do you request in a typical month these days?

RESPONDENT: I probably request only one every two to three months.

INTERVIEWER: What's the highest educational degree you have received?

RESPONDENT: M.D.

INTERVIEWER: And your specialty?

RESPONDENT: Family practice.

INTERVIEWER: And what percent of your time is spent in the following professional activities? I have patient care, teaching, research, and other.

RESPONDENT: Patient care is probably 90% and teaching 10%.

INTERVIEWER: And what percent of your time is spent in the following work settings? We have self-employed, group practice, HMO, medical school, hospital, and other.

RESPONDENT: I suppose it would be -- I don't know how you would say residency in there. Let's see, I guess 60 to 70% of my time in the hospital, 30 to 40% of my time in the clinic.

INTERVIEWER: OK. And do you work in [city] and [city]?
RESPONDENT: I'm down in [city] this month. We have some required rotations down here.

INTERVIEWER: What is the population size of [city]?

RESPONDENT: Population is about 50,000 or 60,000.

INTERVIEWER: About 50,000? OK. Any other searches that you can think of that have been especially helpful with patient care?

RESPONDENT: I did one search about VBAC, which is a vaginal birth after Caesarean section.

INTERVIEWER: How do you spell that?

RESPONDENT: V-B-A-C. Vaginal birth after having a Caesarean section.

INTERVIEWER: What was the situation that led you to do the search?

RESPONDENT: That was mainly the general practice situation in [city] at our hospital. Which is that in general they discourage doing that and that they want kind of once someone has had a C-section, go ahead and have another C-section. And I had heard or read some little bits and pieces about how things were going on the popular news that actually were saying that it may be better in terms of morbidity and mortality to do a vaginal--to have a trial vaginal birth after C-section. So I wanted to find out more of the actual research and information on the issue.

INTERVIEWER: So you said at the [city] hospital they--the policy generally was to follow a C-section with another C-section. OK. Just thought I would check. Again, why did you choose to do a MEDLINE search in this case?

RESPONDENT: Because I didn't have--the issue is new enough that it is not in the textbooks. I looked in Williams and it wasn't there. And also because, in specific terms, in [city], which you know is not a university-type place that generally may have all the latest specialists that are up on it, on the absolute latest things, and because the specific policy there is to go ahead and C-section, I wanted to find out what the general medical community's feeling was on the issue.

INTERVIEWER: OK. How did you explain your information need to the searcher?
RESPONDENT: I believe it was specifically VBACs and I probably used C-section. I don't think that one needed too much else. I can't remember if I wanted specifically about safety or mortality because most of the things talk specifically about that but I can't remember if I put those in.

INTERVIEWER: Again, do you know how the search was carried out?

RESPONDENT: No. ... I get the information and the printout.

INTERVIEWER: What information did you gain from this search?

RESPONDENT: I got some specifics on studies that indeed showed that the morbidity and mortality was less on VBAC than on routine C-section and also had got, along with the search specifics that I was looking for, there were a few other different articles that I don't remember the details ...

INTERVIEWER: In what specific ways was the information helpful to you?

RESPONDENT: It (was) mostly my own knowledge and what I am going to want to do and can't, and it doesn't really affect and not really able to affect what I do with my patients at this hospital right now.

INTERVIEWER: OK. So it won't immediately affect your (patients).

RESPONDENT: I'm afraid not immediately because of -- I mean, what I can do, what I was able to do was was explain to my patients what the different issues were, but that if they really wanted to have a vaginal birth, basically at this hospital they would have to refuse permission to have a Caesarean section.

INTERVIEWER: OK. So if the patient requests the vaginal, they could go ahead.

RESPONDENT: Basically, what they have to do when somebody comes in and tells them they should have a Caesarean section because there's a danger not to, then I can tell them--all I can do is give them the information so that if I'm not there, which I can't always be there, I don't want that ...

C-19
INTERVIEWER: Has this affected any patients so far?

RESPONDENT: There have been -- I've had about three or four patients who had initially desired a vaginal delivery and discussed it with them. One of them ended up having a complication where they needed a Caesarean section. One of them I wasn't there and she kind of got threatened into having a Caesarean section, and another one ended up deciding that she preferred having the Caesarean section anyway. It's more been that I was able to talk with them and to feel that I was able to give them the right kind of counseling.

INTERVIEWER: How long ago did this search happen?

RESPONDENT: This one was around May or June of last year.

INTERVIEWER: And would you describe these as your own patients?

RESPONDENT: Yes.

INTERVIEWER: And, on what service were you seeing them?

RESPONDENT: This was through my clinic.

INTERVIEWER: Where again was this search performed?

RESPONDENT: [City].

INTERVIEWER: And did you ask for any abstracts with this search?

RESPONDENT: No. It was again from the actual articles.

INTERVIEWER: Did you speak with the searcher or did you do the same thing where you filled out a form and wrote down some notes?

RESPONDENT: Basically we wrote it down.

INTERVIEWER: Any other searches that you can think of that have been especially helpful or ones that were unsatisfactory?

RESPONDENT: The only ones that have been somewhat unsatisfactory have been more that I haven't been able to get all the articles by the time I needed them. For example, I was giving a talk on sexism in medicine and did a search about two weeks ahead of time and the librarian was only able to
get two or three of the articles that I was interested in by the time of the talk. But that's basically all the actual (I have to think now)... Actually, on that particular one too, it's hard to know how many articles have been written on the subject, but I was able to get as much--there wasn't as much on the search list that I would have been interested in looking at that would have helped with the talk as I would have liked. I don't know if ... nothing has been written. I wasn't able to think of the right code word.

INTERVIEWER: Would you say that it was an unsatisfactory search overall, though?

RESPONDENT: I would probably more say to you that I got a few good articles out of it.

[Only two incident reports per interview are included.]
Incident # 02-U024-01

Effective Incident Report Form—Mediated User

What was the situation that led to your need for this search? I had a patient who was very ill with Crohn’s disease. She had lost a lot of weight, and it was very dangerous to her health. She also had other intestinal problems, as well as depression. I wasn’t familiar with the latest ways of managing the problem, specifically, the nutritional aspects and the other complications. We were also considering surgery as an option.

What specific information were you seeking? I wanted the latest information on managing weight loss, intestinal problems, and depression associated with Crohn’s disease.

Why did you choose to do a MEDLINK search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? I wanted the latest information, and also good review articles. I looked at textbooks, but they didn’t have any depth of information. Colleagues were not much help.

How did you explain your information need to the person carrying out the search? I asked her to use the terms “Crohn’s” and “complications of nutrition.”

How was this search carried out to get the information you needed? I don’t know how the search was done.

What information did you obtain as a result of this search? I got several good review articles. I also got some articles specifically about nutritional support and intestinal complications.

In what specific ways was this information helpful in your decision making? It gave me background for thinking about my patients. I can’t remember if our specific choice of treatment was guided by the references, or if we got advice from a consultant.

What was the impact on the situation of having this information? We did home hyperal  with this patient—a central venous line for hyperalimentation, for giving sugar and fats and protein IV. We decided that she didn’t need surgery at this time.

What was the outcome of the situation? She went home, gained weight, and got pregnant—she did well. Her prognosis for Crohn’s is that she will eventually need surgery, because her disease is still active. But she hasn’t needed surgery yet, and it’s been over a year.
8. When you obtained the citations, did you request the abstracts?
   [ ] Yes [ ] No [ ] Don't know [ ] N/A

9. Did the abstracts provide sufficient information for your needs?
   [ ] Yes [ ] No [ ] Don't know [ ] N/A

10. Did you subsequently look at any of the articles?
    [ ] Yes [ ] No [ ] Don't know [ ] N/A

11. [If No] Why was this?
    [ ] N/A
    [ ] New articles not yet reviewed
    [ ] New articles not yet available
    [ ] New articles not yet published
    [ ] Other (specify)

12. What system was used to access MEDLINE?
    [ ] N/A
    [ ] Direct access, command language
    [ ] NLM FAST command language
    [ ] Other (specify)

13. How did you communicate the requirements of your search to the person who performed the search?
    [ ] N/A
    [ ] Directly, in person
    [ ] By phone
    [ ] In writing

14. Were you present when the search was performed?
    [ ] Yes [ ] No [ ] Don't know

15. Ask following questions once, after last incident:

16. How long have you been requesting MEDLINE searches?
    [ ] Less than 1 month
    [ ] 1-6 months
    [ ] 6-12 months
    [ ] 1-2 years
    [ ] More than 2 years

17. How many MEDLINE searches have you requested?
    [ ] N/A
    [ ] Less than 100
    [ ] 100-200
    [ ] 200-500
    [ ] More than 500

18. How many searches do you request in a typical month?
    [ ] N/A
    [ ] Less than 1
    [ ] 1-3
    [ ] 4-10
    [ ] More than 10

19. [Blank]

20. What is the highest educational degree you have obtained?
    [ ] N/A
    [ ] Bachelor's
    [ ] Master's
    [ ] Doctorate

21. What percent of your time is spent in the following professional activities?
    [ ] N/A
    [ ] Patient care
    [ ] Teaching
    [ ] Research
    [ ] Administration

22. What percent of your time is spent in the following service?
    [ ] N/A
    [ ] Self-employed/sole practice
    [ ] Group practice/partnership
    [ ] Hospital
    [ ] Government agency
    [ ] Independent consultant

23. What area community do you work in (does your practice/hospital serve)?
    [ ] N/A
    [ ] Rural
    [ ] Suburban
    [ ] Urban

24. Date of data collection

25. Location of respondent
    [ ] N/A
    [ ] City, State

26. Location of interviewer
    [ ] N/A
    [ ] City, State
Incident # 02-U024-02
Effective Incident Report Form—Mediated User

What was the situation that led to your need for this search? (Subject is a resident at a hospital.) It is the general policy of this hospital (in a small rural city in California) to discourage vaginal deliveries after a caesarian section has occurred. I had read and heard in the media that it may actually be better, in terms of morbidity and mortality, to try for a vaginal delivery after C-section. So I wanted to learn more about the research on the topic.

What specific information were you seeking? Research on vaginal delivery after C-section (VBAC).

Why did you choose to do a MEDLINE search instead of consulting some other information source you had available, such as textbooks, journals, or colleagues? Issue is too new for textbooks. I wanted to find out what the general medical research community thinks about this issue. My colleagues here are not in favor of VBAC’s.

How did you explain your information need to the person carrying out the search? I asked them to search for VBAC and repeat C-section. I can’t remember if I specifically asked for safety or morbidity and mortality data.

How was this search carried out to get the information you needed? I don’t know.

What information did you obtain as a result of this search? I got some specific studies that showed that morbidity and mortality were lower for VBAC than for repeat C-sections.

In what specific ways was this information helpful in your decision making? This mainly affects my own knowledge and plans for the future. It can’t directly affect what I do with my patients because of the hospital’s policy.

What was the impact on the situation of having this information? Now I explain the issues to my patients, and advise them that they (i.e., patients with previous C-section) might want to request a vaginal delivery even though the hospital recommends a C-section. The way it stands, the vaginal delivery won’t happen unless the patient requests it.

What was the outcome of the situation? Since the search, I’ve had 3 or 4 patients (with previous C-section) who said they wanted a vaginal delivery. One had a complication and so a C-section was performed. One got threatened into having a C-section when I wasn’t around. Another changed her mind and decided to have a C-section.
8. When did you obtain the citations, did you request the abstracts? [31] Q Yes [1] Q No [3]
   Q Don't know [7] Q N/A [-9]

9. Did the abstracts provide sufficient information for your needs? [32] Q Yes [1] Q No [-3]
   Q Don't know [7] Q N/A [-9]

    Q Don't know [-7] Q N/A [-9]

11. [If No] Why was this? [34-1] Q None of the articles looked useful
    [34-2] Q Abstracts had enough information
    [34-3] Q Too difficult to obtain articles
    [34-4] Q No time to obtain articles
    [34-5] Q Not requested (did search for someone else)
    [34-6] Q No immediate need
    [34-7] Q Other (specify) [34-8]

12. What system was used to access MEDLINE? [37-1] Q Direct access, command language
    [37-2] Q Direct search, command language
    [37-3] Q Direct search, form access/menus
    [37-4] Q Other (specify)
    [37-5] Q Don't know

13. [If Direct search was used] Which version of Direct search was used in this search? [40] Q D1 (3/85) [-1] Q D2 (3/87) [-3]
    Q D3 (10/88) [-3] Q D4 (12/88) [-7] Q Don't know [-3]

14. How did you communicate the requirements of your search to the person(s) who performed the search? [43-1] Q Direct discussion with searcher
    [43-2] Q Filled out search request form
    [43-3] Q Other (specify) A Discussion and Write Key Words

15. Were you present when the search was performed? [48] Q Yes [1] Q No [-3]

Ask following questions once, after last incident:

16. How long have you been requesting MEDLINE searches? [49] Q <3 months [-1] Q 3-6 months [-3]
    Q 6 months-1 year [-3] Q >1 year [-7] Q Don't know [-9]

17. How many MEDLINE searches have you requested? [50] Q 1-10 [-1] Q 11-20 [-2]
    Q 21-30 [-3] Q 31-100 [-4] Q More than 100 (specify) [-6]

18. How many searches do you request in a typical month? [51] Q <1 [-1] Q 1-3 [-2] Q 4-10 [-3]
    Q More than 10 (specify) [-4]
APPENDIX D

CHARACTERISTICS OF RESPONDENTS AND SEARCHES
<table>
<thead>
<tr>
<th>Q26A (Location of interviewer)</th>
<th>Q26B (Source of respondent)</th>
</tr>
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<tbody>
<tr>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
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</tr>
<tr>
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</tr>
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</tr>
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D-1
### TABLE OF TYPE BY Q26B

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<th>Q26B (Source of respondent)</th>
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<td>-----</td>
</tr>
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<td>End User</td>
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</tr>
<tr>
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<tr>
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### TABLE OF Q1 BY TYPE

Q1 (How long ago did the search occur?)

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<th>Percent</th>
<th>Col Pct</th>
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<th>Total</th>
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<td>17.87</td>
<td>103</td>
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<td>19.05</td>
<td>80</td>
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<td></td>
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<td></td>
<td></td>
<td>19.45</td>
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<td>16.03</td>
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<td>192</td>
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<td></td>
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<td></td>
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Frequency Missing = 1
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</tr>
<tr>
<td>Percent</td>
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</tr>
<tr>
<td>Col Pct</td>
<td>END USER</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------</td>
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<tr>
<td></td>
<td>55.96</td>
</tr>
<tr>
<td></td>
<td>85.04</td>
</tr>
<tr>
<td>Ineffective</td>
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<tr>
<td></td>
<td>9.84</td>
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<td></td>
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<tr>
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Characteristics of Respondents
TABLE OF Q16 BY Q26B

Q16 (How long been req/perform. searches?)

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<tr>
<td></td>
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<td>1.82</td>
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</tr>
<tr>
<td>3-6 months</td>
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<td>5</td>
<td>2</td>
<td>4</td>
<td>11</td>
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<td>1.82</td>
<td>4.94</td>
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</tr>
<tr>
<td>6 mos - 1 year</td>
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<td></td>
<td></td>
<td></td>
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<td>34</td>
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<td></td>
</tr>
<tr>
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Frequency Missing = 1
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<th>U. Texas</th>
<th>Total</th>
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<td>10</td>
<td>100</td>
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Frequency Missing = 3
### TABLE OF Q18 BY Q26B

**Q18** (How many searches in a typical month?)
**Q26B** (Source of respondent)

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<th>UCLA</th>
<th>U. Texas</th>
<th>Total</th>
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</tr>
<tr>
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Frequency Missing = 2

### TABLE OF Q19A BY Q26B

**Q19A** (Learn to search: Self)  **Q26B** (Source of respondent)

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<th>Total</th>
</tr>
</thead>
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Frequency Missing = 229
### TABLE OF Q19B BY Q26B

Q19B(Learn to search: NLM 6 hour class)  
Q26B(Source of respondent)

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Frequency Missing = 241

### TABLE OF Q19C BY Q26B

Q19C(Learn to search: NLM 3-5 day class)  
Q26B(Source of respondent)

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Frequency Missing = 244

D-9
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<th>Percent</th>
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Frequency Missing = 250

### TABLE OF Q19E BY Q26B

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Q22--WORK SETTING

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1 Percent of respondents spending any time on each professional activity and in each work setting.

2 Mean percent time spent for those reporting spending any time on a given activity or in a given work setting.
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1 Percent of respondents spending any time on each professional activity and in each work setting.

2 Mean percent time spent for those reporting spending any time on a given activity or in a given work setting.
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1. Percent of respondents spending any time on each professional activity and in each work setting.

2. Mean percent time spent for those reporting spending any time on a given activity or in a given work setting.
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Col Pct | End User | Mediated User | Total
--- | --- | --- | ---
Admin | 21 | 40 | 61 |** 35.06**
 | 12.07 | 22.99 | **35.06**
 | 20.19 | 57.14 | **35.06**
Personal learning | 35 | 10 | 45 |** 25.86**
 | 20.11 | 5.75 | **25.86**
 | 33.65 | 14.29 | **25.86**
Consulting | 18 | 10 | 28 |** 16.09**
 | 10.34 | 5.75 | **16.09**
 | 17.31 | 14.29 | **16.09**
Other | 30 | 10 | 40 |** 22.99**
 | 17.24 | 5.75 | **22.99**
 | 28.85 | 14.29 | **22.99**
Total | 104 | 70 | 174 |** 100.00**
 | 59.77 | 40.23 | **100.00**

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<th>Percent</th>
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### TABLE OF Q4 BY TYPE

Q4 (Were MeSH headings used?)

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Total: 762 396 1158

65.80 34.20 100.00

### TABLE OF Q5 BY TYPE

Q5 (Were Boolean operators used?)

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Q11((If q10 no), Why not?)  TYPE(Type of use)

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</tr>
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TABLE OF Q12 BY TYPE

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## TABLE OF Q14A BY TYPE

Q14A (Always accessed Medline this way?)

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TABLE OF Q15A BY TYPE

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</tr>
<tr>
<td>SEARCH REQ. FORM</td>
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<tr>
<td>OTHER</td>
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Frequency Missing = 762

TABLE OF Q15B BY TYPE

Q15B (Were you present during search?)

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<tr>
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</tr>
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</tr>
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Frequency Missing = 762
APPENDIX E

EXAMPLES OF CASE STUDY ABSTRACTS
Incident #U02401  Mediated User  Effective
A family physician practicing in a metropolitan area was seeking the most recent information on managing weight loss, intestinal problems, and depression for a woman patient with Crohn's disease. The patient had lost a lot of weight, which was endangering her health, had other intestinal problems, and was suffering from depression. A hospital librarian carried out a MEDLINE search with abstracts of the citations. The physician obtained several good review articles and additional articles on intestinal complications and nutritional support. The patient was treated with home hyperalimentation, wherein an intravenous catheter is used for providing sugars, fats, and proteins. It was decided that surgery was unnecessary. She returned home, gained weight, became pregnant, and generally did well. Eventually surgery may be required because her Crohn's disease remains active.

Incident #U02402  Mediated User  Effective
A family practice resident at a small rural hospital was seeking morbidity and mortality data about trials of vaginal delivery after caesarian section, because the hospital policy was to advise repeat caesarian section, and vaginal delivery was tried only when requested by the mother. She wanted to learn more about the clinical research on the topic in order to advise her patients. The hospital librarian carried out a MEDLINE search and located specific studies showing that morbidity and mortality were lower for vaginal birth after caesarian section. She now can explain the issues to her patients with previous caesarian sections and advise them to request a trial of vaginal delivery if they want one. Of three patients with previous caesarian section who wanted vaginal deliveries, one developed a complication and a caesarian section when the resident was not present, and another changed her mind and decided to have a repeat caesarian section.

Incident #044301  End User  Ineffective
An academic oncologist in a medical school was writing an article on a study she had done on the recurrence of breast cancer in the chest wall. She wanted to review the literature on clinical studies of patients who had been treated with surgery and adjuvant chemotherapy only, and later had a recurrence in the chest wall with no other evidence of cancer. Using direct access, she searched MEDLINE from her office and found only four articles on this subject. The search results were somewhat unsatisfactory because the physician had difficulty isolating this particular therapeutic sequence from studies of patients with mastectomies followed by different types of surgery and therapies. She was pleased, however, to have found one particular article by a researcher who was very likely to review her manuscript for publication. As a result of her own study, her advice to patients has changed; experts were previously recommending only surgery and chemotherapy alone, which she showed resulted in a high incidence of chest wall recurrences, as high as 40% in large primary tumors with positive axillary nodes. She now recommends post-operative radiation in these patients.
Incident #045201    End User    Effective
The head of maternal and child health at a hospital needed to revise an old policy and procedures for managing strep infections. He needed new information on strep throats, specifically, proper antibiotic treatment. His Grateful Med search produced the information that answered all of his questions, and he was able to rewrite the hospital's policy, including a fact sheet with a summary of recent and old clinical findings, indications for throat cultures, and treatment. At the date of this report, the physician had just finished preparing the policy. He feels that it is a good one and will lead to patients getting better care and staff feeling more comfortable with a consistent approach to treatment.

Incident #045202    End User    Ineffective
A pediatrician, in a small community, was asked by a colleague to do a search for the latest literature on the diagnosis and treatment of thrombocytopenia, because he had an inpatient with the disorder. He did a MEDLINE search using Grateful Med from home, but found nothing useful. He either found thousands of citations or nothing. His colleague treated the patient without new information, but the outcome for the patient was not known by the respondent.

Incident #046602    End User    Effective
Two years ago, a research scientist in a medical school was planning an approach to the problem of transforming plants to produce ovalbumin (chicken egg white). He needed to find the gene sequence and he had forgotten where it had been published. He carried out a MEDLINE search from the laboratory office and found a series of papers, which he was not aware of, that contained the properties and the sequence of the ovalbumin gene and techniques for its isolation and utilization. Given this information, his team devised a long-term research project to clone the gene into a plasmid with which they could transform plants to increase their nutritional value. They were successful in transforming carrot, potato, and petunia plants to produce ovalbumin. Recently, he reported their findings at a professional meeting, and the study has been funded for another three years. Ultimately, these plants, which are more nutritious, may become commercially available.
Incident #U07402    Mediated User    Effective
A psychiatric social worker had several autistic children as patients. They had good language and learning skills but were significantly depressed. She had heard from a psychiatrist about a new syndrome called Asperger's syndrome that seemed to describe these children, and wanted to know more about it. She asked a medical librarian to conduct the search and learned that there is disagreement about whether or not the syndrome really exists. However, researchers agreed that there is cyclic depression overlaying some cases of autism and that it may be familial. The information helped the social worker convince the hospital review board that autistic children may become depressed. She was able to get more psychotherapy for the patients as well as better counseling for families and teachers on how to deal with them on a daily basis.

Incident #074503    End User    Effective
A question was raised in the AIDS clinic of an academic medical center concerning the utility of beta2-microglobulin test for assessing the activity of HIV infection. A specialist in gastroenterology and infectious diseases wanted to research the topic to prepare a presentation to the AIDS Clinic staff. Using Grateful Med, he did a MEDLINE search at home and obtained information that the test is a measure of disease activity because beta2-microglobulin is shed by cells that are turning over or dying. It is also an index of white blood cell turnover. It was clear that elevated beta2-microglobulin is not a specific test for AIDS and could only indicate how rapidly lymphocytes were being destroyed. He made the presentation and the staff decided not to use the test because of the high cost. They will now know how to interpret the test results if someone else orders it.

Incident #T00801    Mediated User    Effective
A woman, who had had a giant cell tumor removed from her metatarsal several years previously, was found to have recurrent tumors in that foot. The physician assistant was asked to obtain a literature search because a consultant had suggested either amputation or osteotomy as treatment options. The attending physician needed to know what the indications are for amputation. At the medical school library, a MEDLINE search was requested. The articles obtained made it clear that amputation was not indicated if the recurrent tumors were not malignant on biopsy. The physician performed an osteotomy and biopsy, which was negative. The patient's foot was saved and she is doing very well.
APPENDIX F

REASONS WHY THE INDIVIDUAL NEEDED INFORMATION
I. Patient care (494)*

A. Diagnosis and etiology (203)

1. To utilize diagnostic tests and procedures (54)

   a. To help select an appropriate test(s) to diagnose some condition or establish a differential diagnosis (17)

      Had patient with symptoms that could have been chronic granulomatous disease and wanted information on appropriate test to detect this enzyme defect in white blood cells (P20802)

      Had patient with symptoms and unusual Doppler study which suggested internal carotid aneurysm near cavernous sinus and wanted information on appropriate Doppler velocity flow measurement test to dissect out whether patient had aneurysm or not (034901)

   b. To help apply a (new) diagnostic procedure correctly (9)

      Had patient with suspected angiomyolipoma and was looking for specific article on doing and interpreting CT scan of renal mass (P10501)

      Had several patients with symptoms of lower abdominal pain who ended up with unexpected ectopic pregnancies and was looking for the diagnostic clues for ectopic pregnancy; wanted information on doing and interpreting colocentesis and endovaginal ultrasound (016301)

* Number in parentheses are the numbers of incidents classified in each category
c. To evaluate test sensitivity/specificty (4)

Had patient with possible carcinoid syndrome, who when tested had a high value of acetic acid in the urine, and wanted information on any chemical interferences with the test that could produce these results (077801)

Had patient with suspected Paget's disease, and needed information on "3-dot sign" on the bone scan being specific for Paget's disease, as a colleague had told him; wanted information on how specific it was to Paget's disease versus bone metastasis (040001)

d. To help interpret test/diagnostic procedure results correctly (24)

(1) To determine whether test/procedure results were within normal limits (8)

Had patient with observed levels of chlorophenol, an environmental toxin, in tissue; wanted information on normal levels for this toxin in human tissue and whether such levels had been established (P11902)

Had a patient with suspected biliary tract disease and wanted to know whether ultrasound of duct showed pathology or was within normal limits for the patient's age (038302)

(2) To better understand relationship of test/procedure results to particular diagnoses (16)

Had patient with suspected gallstones--blood tests and liver tests were consistent with this Dx, but ultrasound was not--and wanted information on false negative rates for ultrasound and specificity of blood tests (011404)

Had request from another physician who wanted to know whether there was anything in the literature to suggest that the size of a renal tumor, when discovered, was related to kind of tumor (P10503)
2. To establish a differential diagnosis (149)
   a. To help establish diagnosis for presenting symptoms (73)
      (1) To suggest a possible diagnosis and etiology (12)

         Had pediatric patient with symptoms of granulomatous hepatitis and bone marrow failure and wanted review articles on disease that would fit that combination of symptoms (I) (02102)

         Had young patient with symptoms which appeared like multiple strokes and wanted information on the cause of the strokes; needed information on specific collagen vascular disease which might be the cause (060701)

      (2) To obtain evidence to support/disprove a hypothesized diagnosis (25)

         Had patient with uncommon symptoms of bilateral, localized swelling of the eyes and wanted case reports or other information to suggest a probable diagnosis (P11001)

         Had patient with symptoms that might have arisen from exposure to a particular substance (e.g., joint swelling possibly associated with wound from the thorn of a particular shrub) and wanted to know whether the substance was known to cause such symptoms (P11901)

         Had several patients with multiple miscarriages early on in their pregnancy, and wanted evidence of whether luteal phase defect was a true diagnostic entity. (16302)

      (3) To differentiate between two hypothesized diagnoses or disease variants (11)

         Had number of cases reported of measles (physician works for state health department) which had blood tests done that did not confirm measles and needed information on rash-type diseases such as those caused by parvoviruses and how to diagnose them (I) (045302)
Was evaluating radiographic image and wanted to know if image was more consistent with otitis external or a tumor (038303)

(4) To identify or evaluate possible alternative diagnoses when most common diagnosis has been ruled out or is doubtful (2)

Had patient with symptoms of headache and neck pain which most likely indicated a brain tumor, and needed information to confirm that symptoms could also be caused by high cervical spine disease (I) (060702)

Had pediatric patient with lesion of the mesentery 2-3 years after a liver transplant that looked like a leiomyosarcoma but it was unusual because this type of tumor is usually in adults; physician was looking for information on other secondary tumors that can occur in transplant patients who are immunosuppressed (067701)

(5) To help interpret symptoms or physical findings which appear inconsistent with probable diagnosis (8)

Had several pediatric patients with abdominal lymphadenopathies that looked like progressive transformation germinal centers and needed any reports of presentation in the abdomen because this is highly unusual (I) (065801)

Had neonatal patient with symptoms of myoclonus including jerking to touch and apnea which appeared life-threatening (while most literature suggests it is benign) and needed information on the range of benign neonatal myoclonus (058001)

(6) To determine or better understand the cause of a diagnosed condition (15)

Had patient who had lost her baby at term through massive abruptio placentae and needed information to understand the etiology of such an occurrence (039601)

Had patient with diffuse hair loss and needed information to understand the etiology of diffuse alopecia; was not able to obtain any references on
etiology of the condition and had to get the information from a textbook (I) (032001)

b. To diagnose cause of new symptom(s)/change of condition in patient(s) under treatment (76)

(1) To obtain evidence to support/disprove hypothesis that new/additional symptoms are part of known/preexisting medical problem (17)

Had patient in emergency room in extreme cardiogenic and anaphylactic shock and suspected the cause to be the homeopathic medicine she took for poison ivy; needed information on myocardial depression secondary to anaphylaxis rather than a separate problem (039602)

Had patient with severe intestinal problems and extreme depression and needed information on depression caused by the physical problems (as well as information on chronic pain management) (U07403)

(2) To obtain evidence to support/disprove hypothesis that observed symptoms are due to a medication side effect (25)

Had patient with leukopenia who was on several new cardiac drugs and wanted to know if any of those drugs has been implicated in leukopenia (032401)

Physician and colleagues thought they were seeing extrapyramidal reactions as side effects of antipsychotic drugs being administered to their AIDS patients and wanted to know whether these side effects had been observed by others (P20601)

Had patient who appeared to be experiencing an severe skin reaction to mitomycin-C, a chemotherapy agent being administered via catheter to the bladder, and wanted to know if similar reactions had been seen in other patients (P31103)

(3) To suggest other (non-drug related) iatrogenic causes that might underlie observed problem (13)

Had a number of pediatric burn patients who were having electrolyte problems that seemed to become more acute after hydrotherapy and wanted to know if
anything about the hydrotherapy could be causing the imbalance (P30201)

Had penicillium mold show up in cultures taken intraoperatively during heart valve surgery and wanted to know if the mold could cause postoperative infection and where it was coming from in the hospital environment (P21201)

(4) To determine whether two conditions previously had been observed to be associated and due to a common cause (21)

Was consulting on a patient with an unusual combination of symptoms—acute episodic hypertension and hyperparathyroidism; needed any reports of previous observations of this presentation, the diagnosis and treatment (U16201)

Had newborn patient with congenital heart defect and absent fibula and needed information on any reports of this combination of birth defects (I) (U02002)

Had stillborn infant, at autopsy, who had a presumptive diagnosis of Down's syndrome but also was found to have abnormal cells in blood vessels which suggested congenital leukemia; needed to know if there was a link between the two conditions. (036103)

B. Treatment and prognosis (253)

1. To obtain general information to support choice of treatment and determine prognosis for a presenting condition (90)

a. To identify any treatment options for a known condition (17)

Had pediatric patient with an abnormal CAT scan of the head which resulted in a diagnosis of cystic hygromas and needed information on any treatment options for the condition (I) (U12801)

Had patient with a rare condition, an aspergilloma, or fungus ball, in the left maxillary sinus and needed information on any recommended therapies for the condition (U09401)
b. To obtain evidence to support/reject use of given treatment option (31)

Had patient with a complicated hernia of the esophagus and upper stomach–paraesophageal hernia–and needed confirmation on whether to perform a fundus wrap in addition to repairing the hernia (U11801)

Had patient with hydrocephalus and needed information providing technical descriptions of third ventriculostomy procedure for internal treatment of the condition and the results, in order to decide if the procedure was worth doing (I) (U01201)

Had several patients with recurrent primary carcinoma of the peritoneum, and needed information on the use of intraperitoneal chemotherapy as a possible treatment for this condition. (U05602)

c. To evaluate the relative merits of two drugs or procedures for a particular medical problem (11)

Wanted to inform own practice and that of colleagues by comparing two drugs or procedures on a specific criterion (e.g., success rates for angioplasty vs. surgery to treat femoral artery disease) (040502)

Nurse had patient for whom surgeon recommended using a permacath for long-term TPN (total parenteral nutrition). Nurse understood permacath was appropriate for dialysis, but that Groshong catheter was more appropriate for TPN, and wanted information on patient outcomes with Groshong catheter for TPN to support her position (U11202)

d. To evaluate a treatment prescribed by a prior or referring physician (8)

Had a former patient who returned for a second opinion on bypass surgery and wanted to provide an unbiased perspective on indications for this procedure (P12402)

Had patient, transferring from a physician in another city, who was taking gancyclovir for cytomegalovirus and wanted information about this drug (040102)
e. To determine the necessity/advisability of surgery versus observation/medical treatment for a particular condition (8)

Had patient with small adrenal mass where another physician recommended removal; needed recent reviews on the issue of removal of the mass versus evaluation over time (068502)

Had patient with thyroid nodules which the referring physician recommended be removed; physician suggested treatment with thyroid suppressant and needed recent literature to support his position (U16202)

f. To determine the need for treatment (e.g. radiation or chemotherapy) in addition to surgery (4)

Had patient with a chordoma in sacral area who had been treated surgically, but tumor had not been totally excised. Physician needed information on whether radiation therapy would be useful in this situation (070301)

Had female patient in late twenties with a very large acoustic neuroma which had grown onto her brainstem and could not be completely surgically removed, and needed information on whether to recommend radiation therapy (070302)

g. To determine what is the appropriate treatment in the presence of a second disease/condition in the patient (11)

Had a number of patients who were hypertensive, as well as having asthma or some reactive airway problem, and beta blockers were contraindicated. Physician had recalled that angiotensin-converting enzyme inhibitors might be a candidate to treat hypertension and wanted information on the action of this group of drugs on patients who have asthma (022601)

Had patient with psoriatic arthritis who also had underlying liver disease, so the usual treatment with methotrexate was contraindicated. Patient’s dermatologist recommended a Vitamin A compound and respondent was not familiar with this treatment and needed information on its use in these circumstances (023501)
2. To obtain information on the clinical course and general management of a relatively rare disease/condition (51)

   a. To determine the course and general management of a condition unfamiliar to practitioner (25)

      Had a series of patients who showed symptoms of contact dermatitis because of an allergy to nickel, and wanted to know how to manage the patients, including any cross-sensitivity to other compounds such as chemicals used in formulating ointments (066001)

      Had a patient with pigment deposits in the retina as a consequence of having taken canthaxanthine, an oral "suntanning" medication, and wanted to know prognosis for visual deterioration and for cosmetic appearance of the eye (P30101)

      Had patients with chronic systemic candidiasis and needed information on the management of this condition with which he had limited prior experience. (069103)

   b. To determine the clinical course, prognosis, and general management of a specific neoplasm (19)

      Had patient who previously had surgery and radiation therapy for prostate cancer, which now had metastasized to the orbit of the eye with a loss of vision, and needed to know how rare this is and what is the treatment and prognosis (034201)

      Had patient who had been previously diagnosed as schizophrenic, who was now pregnant, and whom the psychiatrist initially misdiagnosed as cured because of a lack of symptoms, and wanted any reports of estrogen as an antipsychotic drug or cases where pregnant schizophrenics appeared cured (064802)

   c. To determine the potential impact of pregnancy on preexisting medical problem (7)

      Had a patient with a history of malignant melanoma who was now pregnant; wanted to know if pregnancy would have any influence on the course of the disease (P31101)
Had a patient who had lupus anticoagulant and was pregnant; wanted to know what was the current state of therapy of management of these patients during pregnancy. (059904)

3. To obtain information on the impact of a medical problem on the management of another condition or problem (16)

a. To determine impact of condition and/or its treatment on general management of primary care (2)

Had a new pediatric patient with William’s syndrome and wanted to know general features of the syndrome (P10102)

Had a general practice patient who was also being treated for IgA deficiency by a pulmonologist (using gamma globulin) and wanted general information about the condition and its treatment (010401)

b. To determine impact of condition and/or its treatment on pregnancy and appropriate management during pregnancy and delivery (8)

Had patient with diabetes insipidus who was now pregnant; needed information about the use of medication during pregnancy and problems encountered during delivery (U13601)

Had patient with relatively rare condition—thrombocytopenia, an elevated platelet count, who was about to get married and was concerned about the possibility of pregnancy. Physician wanted to know the impact of the condition on pregnancy management (U08001)

c. To determine implications of condition or its treatment for anesthesia management (3)

Had to administer anesthesia to a patient with an unusual disease or condition (Sandhoff’s disease) and wanted to know implications for anesthesia management (P20502)

Had patient diagnosed with neuroleptic malignant syndrome who was to undergo surgery, and wanted to know everything about the disease and how to manage the patient anesthetically (P10804)
d. **To determine impact of condition and/or its treatment on the potential outcome of surgery (3)**

   Had a patient with diabetes and gallstones and wanted to know current mortality rates for such patients and whether early surgical removal of stones was still recommended (P21203)

   Had patient with Von Willebrand’s syndrome, an hereditary bleeding disorder, who was scheduled for urologic surgery; needed to know how to manage the condition during and after surgery (032002)

4. **To obtain information on the proper use of one or more specific treatment options known to the physician for a specific condition (22)**

   a. **To determine whether there were any known guidelines for applying treatment in an unusual situation (2)**

      Had a patient who had had blood accidentally injected into spinal canal during epidural anesthesia and wanted to know what should be done for the patient (011301)

      Surgeon was unable to plug the renal vein into the iliac vein during kidney transplant operation because the vena cava was totally occluded, so he plugged the renal vein into the portal vein. He subsequently wanted to know if this had ever been done before (T04101)

   b. **To identify information that could prevent procedural mishaps (3)**

      Had a patient in whom the indwelling Hickman catheter broke, leaving a fragment lodged in lung, and wanted to know how this happened and how to prevent it in the future (029103)

      Generally interested in new ideas for preventing aspiration as a consequence of anesthesia in a child with a full stomach (I) (P11702)

   c. **To evaluate potential side effects of a treatment (11)**

      Was asked to consult on patient with osteoporosis and a history of breast cancer and wanted to know risk of reactivating cancer if osteoporosis was treated with estrogen therapy (015602)
Had patient admitted to emergency room with snakebite and wanted current information on the trend toward or away from recommending universal use of antivenin because of the high rate of anaphylaxis and delayed allergic reaction to the antivenin (U04602)

d. To obtain information on possible new uses of a known treatment (6)

Had veterinary patients who were treated for a wide variety of parasites with a group of parasiticides called Ivermectines and wanted to know if there were other uses of these agents of which he was unaware (043401)

Had patient with asthma for whom the physician prescribed Robinul in a nebulizer every 6 hours. Pharmacist only knew of its use as an oral antispasmodic and wanted to identify articles where Robinul had been used by inhalation for asthma (059703)

5. To obtain information on new or alternative treatments for a specific condition (65)

a. To evaluate a promising new treatment or variation not readily available in the U.S. (4)

Had patient with Hodgkin's disease who relapsed while on IV chemotherapy (ABVD) and wanted to know more about oral therapy using CEP protocol, which includes prednimustine, an investigational drug which is only generally available in Europe, or through NCI on a compassionate basis (037402)

Had pediatric patient who had ethylene glycol poisoning (swallowed antifreeze) and wanted information on the use of 4-methyl pyrazole in treating the condition, since it has been used although it had not yet been licensed for use in the U.S. for this purpose (066701)
b. To obtain information on a treatment with which physician is not familiar (40)

(1) To determine if treatment is appropriate alternative for specific patient (24)

Had pediatric patient who was a near-drowning victim who required mechanical ventilation for a long time and had recurrent pneumothorax which kept him in the hospital longer than expected and wanted to know if sclerosing the lungs would be worthwhile procedure to perform on the child and what were the risks and benefits (T07001)

Had pediatric patient with myoclonus which he wanted to treat with a drug that increases serotonin and seemed to work in similar cases. Since drug was experimental, wanted to know if another drug, fluoxetine, which modifies brain serotonin in adults, has been used in children and its safety (035403)

Had patient with unusual hemangioma because it was limited to the pinna and was quite aggressive, and physician wanted to know if resection would be preferable rather than usual treatments of observation only or argon laser treatment (057102)

(2) To determine if treatment would be of use to future patients (16)

In order to treat future pediatric patients appropriately, physician wanted to know proper dosage for Fentanyl which is a potent narcotic used as an anesthetic agent for surgery in premature infants, since the search was done after the surgery had been completed on his current patient (033802)

Had heard about use of calcitonin to treat osteoporosis and needed information that showed that it worked, practical information on how to do the therapy, and possible problems, to determine whether to prescribe it for future patients with osteoporosis (P11502)
c. To evaluate possible alternative treatments when the standard treatments are not working or are causing unacceptable side effects (21)

Had patient with severe rheumatoid arthritis who was on every non-steroidal pain medication, but was breaking through with her pain and could not be treated with methotrexate because of a bleeding ulcer; wanted to know if there were any new medications or new treatment strategies for the pain (010901)

Had patient with substantial groin eczema of long standing duration and wanted to know if there was another treatment for eczema that might help him (I) (041802)

Had patient with heparin-induced thrombocytopenia, which developed into a life-threatening allergic reaction to heparin, and needed to locate an experimental low-molecular weight heparin derivative to possibly use as an alternative (059901)

6. To obtain information on monitoring procedures and techniques (3)

Had a patient whose reattached hand was not doing well and wanted to apply a new monitoring technique, pulse oximetry, to evaluate whether further surgery was necessary (P30202)

Had many trauma cases in which fluid replacement was an issue and was interested in determining most predictive indirect measures of blood volume to guide fluid replacement decisions (P11703)

7. To obtain prognostic information (4)

Had patient with bullous pemphigoid, a rare, life-threatening skin disease, and wanted better prognostic information than was found in textbooks to address the family's concerns (I) (071602)

Had six-month old patient with complete neuroblastoma lesion of the upper thoracic spine and needed the most recent prognostic information for children on the relationship between the length of the interval between symptoms, surgery, and the recovery of function. (066202)

8. To locate specialist for referral (2)

Had patient with back pain for 6-8 months which was diagnosed as a rare endothelial cell sarcoma next to her sacrum who was treated

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with radiation and needed to know who was performing limb-sparing surgery to refer the patient to avoid hindquarter amputation (034905)

Had patient with pancreatic cancer who was on chemotherapy and was going to a southern state for the winter, and needed to refer the patient to an oncologist. (040802)

C. Maintain an effective physician-patient relationship (19)

1. To provide information to patient so he/she could make informed choices (7)

Had a patient with non-Hodgkin's lymphoma; wanted to provide her with copies of review articles on the disease (P12403)

Had a patient with glioblastoma who had received radiation. Nurse-practitioner wanted information to help patient cope with condition and make decision on whether to have experimental surgery (I) (U03702)

2. To advise patient(s) considering participation in a clinical trial (1)

Had several patients with HIV infection and wanted to advise them on merits of joining a clinical trial using isoprinosine (040101)

3. To advise a friend, colleague, or family member on a disease, condition, or treatment outside the physician's specialty (11)

Was contacted by a friend to provide general information on the prognosis and treatment of a disease (sarcoid) newly diagnosed in a family member (P11704)

Specialist in internal medicine had family member with nasopharyngeal cancer and needed to know the latest prognostic information on 5-year survival rates and different treatments to provide guidance to the family (047901)

D. Prevent Disease (13)

1. To obtain information on health maintenance and primary prevention strategies and resources (6)

Was planning to create a booklet that respondent and colleagues could use as a reference for patient education; wanted current
information on change strategies and recommended behaviors re cholesterol intake, smoking, exercise, weight control (010902)

Physician who conducts community talks on the relationship between diet and cancer and recommends nutritional counseling to breast cancer patients after surgery needed the latest research on diet and the development of breast cancer (U19702)

2. **To obtain information pertinent to evaluating life style or environmental risk factors (4)**

Received an inquiry from an individual who was worried about industrial exposure to styrene and wanted information on toxic effects and recommended safety precautions (P30901)

Physician's wife was a medical student who was exposed to formaldehyde and phenol in anatomy class and was pregnant, and physician wanted to know if there were any data which suggested that there were teratogenic effects of inhalation of phenol (T07601)

3. **To obtain information to improve effect of hospital environment on patient (3)**

Nursing staff was considering limiting parent visitation in neonatal ICU to make it easier for the staff to get their work done and needed to know if anyone has studied the impact on parents of having a child in intensive care and how parents adapt to the stress and anxiety of such a situation (U09101)

Nurse was concerned about the effects of the neonatal intensive care environment on the infants in the unit and needed to know what were the effects of the environmental deprivation caused by bright lights, beeping sounds, and lack of day-night sequence (U09102)

E. **Discharge responsibilities to patients and third-party payors (6)**

1. **To identify information to support or deny reimbursement for treatment or procedure by insurance carrier (4)**

Insurance company had ceased defining as "functional" breast reduction to reduce pain associated with extremely large breasts, and physician wanted literature on pain relief from reduction mammoplasty to support a claim (U06202)
Had patient with multiple myelomas for ten years who had been treated with all standard therapies and now was being treated with hemi-body radiation, but the insurance company refused to pay for the procedure because they contended it was experimental and needed evidence from the literature for such treatment (060401)

2. To determine whether patient is entitled to benefits (2)

Had patient who was diagnosed with blepharospasm and asked for compensation because they claimed it was a work-caused problem. Physician needed to find out about causes and aggravating factors of the condition to determine whether the patient was entitled to benefits (U17202)

Had patient, who was now deceased, who had sustained a skull fracture falling off a truck in the course of employment, and the widow wanted the Workmen's Compensation benefits. Physician needed information on neurologic injury or deterioration generally, in order to support the widow's claim against the insurance company. (010802)

II. Research (233)

A. Research planning and execution (128)

1. To determine whether a research area is viable (50)

 a. To determine whether an important problem, knowledge gap, or controversy exists (17)

Was beginning research on a particular area (e.g., the impact of thrombolytic therapy on people with bundle branch blocks) and wanted to review if research had been done examining the effects of thrombolytic therapy on bundle branch block (000501)

Had isolated a maternally-produced retinal binding protein from the uterus of pigs and wanted to know whether any work had been done on vitamin A deficiency or excess vitamin A influencing embryonic survival to see where they should go with this retinal binding protein (I) (013901)
b. To determine whether a proposed study has already been done (11)

Was using a test on afferent pupillary defect and a visual field test and wanted to find out whether anyone had compared the two tests (028201)

Was looking at the connections between colonic polyps and both papilloma virus and skin tags and wanted to know if anyone had published in the field or if this was a field that is open for further research (047501)

c. To determine whether any evidence exists that would support the validity of a given hypothesis or feasibility of an approach (22)

Wanted to determine whether there was preliminary evidence for the benefit of use of systemic retinoids for treatment of psoriatic arthritis (P10603)

Wanted to determine whether significant research questions were unanswered related to homologous recombination in cancer cells (P20901)

Wanted to determine the feasibility of a research project examining photoreleasable compounds. (T00603)

2. To determine the specific target for a research study so as to be the most productive (9)

Was designing an experiment to stimulate the tyrosine-hydroxylase gene expression of dopaminergic neurons and needed recent publications by a particular investigator who does work in this area since research team planned to use the same methodology (T06401)

Was using single photon emission computer tomography and other tomographies to study patients with schizophrenia or Huntington's chorea and wanted to stay abreast of what others were doing to help specify interesting research questions (P20602)

3. To help formulate specific research questions (7)

Was studying oncogene expression in pancreatic carcinomas and wanted to know which, specifically, had already been investigated and which appeared most promising for further study (P20801)

Had seen a patient with an emergency presentation of an aortic aneurysm and wanted to know whether a connection between aortic
aneurysm and lung disease had been reported to assess whether research was needed, because all the patients with aortic aneurysm were also smokers (063101)

4. To choose (more) appropriate variables/factors/conditions for use in research design (21)
   
a. To identify (more) appropriate variables to be manipulated in an experiment (10)

   Needed to know the measured concentrations of sodium inside heart cells in order to plan and interpret experiments (I) (T02502)

   Had an interest in the pharmacokinetics and pharmacodynamics of anesthesia using an animal model and wanted to know how others dealt mathematically with effect measurement data to assess every measurable effect of anesthesia (074401)

b. To identify (more) appropriate factors to be tested in an experiment (8)

   Was designing models to modify cancerogenesis response to UV-radiation and needed treatments that modify the natural history of UV-induced cancerous lesions (P10602)

   Was designing an administrative/personnel experiment on use of child care as a recruitment/retention incentive for nurses working at night and wanted to know what others had found out in this area (P10202)

c. To identify (more) appropriate variables or measures to use in epidemiologic research (3)

   Was designing a study of the relationship between attitudes toward food and eating disorders in China and wanted to know what others had found on eating disorders in non-Western cultures (017902)

   Was involved in a study on the expression of HLADR, a histocompatibility antigen in non-hematolymphoid tumors, and needed to know if there was any evidence in the literature of the expression of HLADR in other neoplasms besides lymphomas in order to assess whether HLADR could
be a parameter to separate interleukin-2 therapy-responders from non-responders (044602)

5. To choose or effectively implement an appropriate methodology (41)
   
a. To identify an appropriate protocol (6)

   Was designing a new project in the area of Epstein-Barr virus and lymphoma and wanted to update information on most current protocols and techniques (P12202)

   Was developing an instrument to assess speech-language development in children and wanted to know how similar instruments had been scaled and validated (P10201)

b. To identify an appropriate laboratory technique (23)

   Was planning a research project to insert the gene that codes for metallothianine into algae to create an alga that removes contaminating metal ions from the environment and wanted to know how to clone the metallothianine gene (046601)

   Was devising a research project to clone the ovalbumin gene into a plasmid to produce plants with a higher protein content and needed the gene sequence of the ovalbumin gene (046602)

   Was looking for the citation for a method for intraocular lens implantation by a specific author for supervisor's research and needed a specific type of implant method described by one individual (I) (042202)

   Was studying the basic biology of asthma and the role of the nervous system in the disease and needed information on fluorescent dyes, Dye-I and Dye-O, which are taken up by nerves and transported to the cell body, which dyes researcher was considering using to study innervation of the respiratory tract (061301)

   Was studying the action of butyrate, which gets metabolized by the acyl-CoA-synthetase in the mitochondria into butyrate-CoA. Renal physiologist did not want this reaction because he was looking at volume regulation, not metabolism, and
needed to know if there was inhibitors of acyl-CoA synthetase which he could use to stop the reaction (052401)

B. Securing research funding or collaboration (34)

1. To obtain background facts to include in a grant proposal (13)

   Was preparing a grant application for a research study in a particular area (e.g., glycoprotein T-200) and wanted to be sure knew all relevant literature (013803)

   Was writing a proposal for preliminary studies of a particular organelle (primary cilium) in cartilage cells and wanted to review studies of these organelles in vestibular hair cells (where they have been more extensively researched) in order to clarify research questions and specific things to look for (012001)

2. To obtain information to justify the significance or appropriateness of a proposed study (14)

   Was preparing a grant application and needed citations to document an assertion concerning a specific protein in liver tumor cell lines (041601)

   Had observed a relationship between growth hormone and obesity—obese people secrete less growth hormone than non-obese individuals—and needed to determine whether this relationship was causative or a secondary factor so that he could prepare a grant proposal (077802)

3. To provide justification for some aspect of a proposed research design or methodology (including submission to FDA for investigational drug) (3)

   Was preparing a grant proposal and wanted specific evidence from the literature to support a point concerning the expression of a cytoskeleton protein, 4.1, in the cell lines hepatoma G2 and hepatoma 3B (041601)

   Was submitting an application to the FDA to use a new nuclear medicine technique for white blood cell labeling and needed specific references that documented procedures and outcomes of the labeling technique (062802)

F-21
4. To identify information to evaluate potential for collaboration with other researchers (3)

Was deciding whether or not to collaborate with other investigators contacted at an international meeting and needed information on their research projects of the past three to four years (013902)

Was planning to introduce papilloma virus protein, synthesized by a possible collaborator, into fibroblast cells to determine whether or not it would metastasize the cells and wanted to make certain that he had not overlooked any of the prospective collaborator's publications (025202)

5. To identify the expertise/interests of potential reviewers in order to decide on the agency component from which to seek funding (1)

Was preparing a grant application for glycoprotein research and wanted to identify a funding agency where at least one reviewer on the study section would have an orientation towards molecular biology and carbohydrate analysis (013802)

C. Performing analysis of published information (8)

1. To perform an analysis of previously published research findings (5)

Had research in progress on polyethylene as a component of total-joint-replacement prostheses and wanted to know more about normal joint wear and types of failures that could occur with prostheses (045401)

Was preparing an epidemiological study of chest wall recurrences of breast carcinoma in women who had adjunct chemotherapy, but no radiation until the recurrence, versus those who had it immediately after surgery, and needed information from previous studies (1) (044301)

2. To perform an analysis of medical views or opinions (1)

Was doing a project on rise of biophysical, high-technology medicine in 20th century and wanted to contrast views of physicians and medical historians (048901)

3. To perform an analysis of research methods (2)

Was involved in a research project evaluating different diagnostic tests for patients with pneumocystis pneumonia, and wanted
information on the sensitivity and specificity of the tests as a measure of their accuracy to diagnose pneumocystis (014001)

Was looking at negative clinical trials for patients with cystic fibrosis for the past 10 years and needed to find all of the studies where there was no difference between two therapies, in order to look at the sample size to do a power analysis. (033401)

D. Interpreting research findings (23)

1. To help refine a theory or model so that it can encompass new findings (5)

   Was attempting to determine whether a protein that binds zinc fit the zinc fingers model of binding and needed examples from the literature of zinc finger proteins (073103)

   Had hypothesized that calcium and calcium channel modulators play a more significant role in the auditory system than was thought and needed to identify and review other research on calcium channels and the auditory system which was applicable to his work (074801)

2. To help understand the significance of certain research findings (10)

   Had cloned a gene (transin) that turned out to be differentially expressed during tumor formation and had done some DNA sequence analysis and found that transin gene was similar to stromelysin, so needed to find out more about substrate specificity of stromelysin (P21501)

   Had found that in cleft palate children who had a breathing impairment, the impairment had a profound effect on the mode of distributing air between the mouth and nose, while in non-cleft children the mode of distributing air was not related to the impairment, and needed to know the incidence of breathing impairment and a definition of impairment, in order to understand the significance of their findings (078101)

3. To help interpret unusual findings (8)

   Had discovered a protein, p-21, which is an expression of the ras oncogene from immunohistochemical studies of brain tissues of patients with Jakob-Creutzfeldt disease and scrapie, and wanted to know whether an association existed between the expression of the ras oncogene and the diseases (046901)
Had discovered an interaction between dimethylsulfate and guanine residues which caused reverse transcriptase to stop in a method to transform messenger RNA in vivo and needed information about the chemical interactions between nucleic acids and dimethyl sulfate (056601)

E. Preparing research reports (37)

1. To determine whether results are sufficiently novel and should be published (4)

   Had just discovered that butanol stabilizes the enzyme alpha glucosidase and wanted to know if there were other reports of butanol protecting an enzyme from deterioration (017701)

   Had seen angiogenesis, the growth of blood vessels, in endothelial cells in tissue culture and needed information on angiogenesis in tissue to determine whether or not system was unique and should be reported (021901)

2. To place own findings in context of most recent research and opinion (33)

   a. To review all current and significant work in own field (21)

      Was preparing paper on own research on steroid binding proteins in plasma and wanted to review most recent literature in field to place findings in context (049301)

      Was preparing a manuscript on progesterone receptors and binding and needed other recent papers on this topic to ensure that no related papers had been overlooked (072601)

      Was preparing a report on the results of testing the efficacy of vaccines for the feline leukemia virus and wanted new articles on immunity to and molecular biology of the leukemia virus (071502)

   b. To obtain specific citation(s) for work to be referenced in report of own findings (12)

      Was preparing a manuscript on research findings and needed a specific reference on relationship between T-200 and fodrin to include in article (013801)
Was preparing a paper on own research and needed a paper which referenced some unpublished observations about DNA bending which researcher wanted to use for background in his paper. (018101)

F. Evaluating research proposals or requests for approval of new drugs/devices (3)

1. To assist in study section review (1)

   Was evaluating grant applications for a metabolism study section on an area of fatty acid binding proteins which was unfamiliar and needed to find out whether or not a connection existed between biological regulation and the amount of protein isolated (074202)

2. To assist in review of investigational drug application (2)

   Was reviewing a request of an investigator to receive an exemption to use mitoxantrone as an experimental treatment for breast cancer, when it was only approved for leukemia, and needed to find doses that were used and whether the drug was safe or not (049901)

   Was reviewing application to FDA for approval of a new drug for treatment of breast cancer, and needed to find all clinical studies of this drug to make sure there were not selective omissions of any negative studies (049902)

III. Teaching (231)

A. Instruction in the basic medical sciences (5)

1. To prepare a lecture for undergraduate college science course (1)

   Wanted background information for a undergraduate class on Drosophila homeobox including current references and state-of-the-art information on the Drosophila homeobox (050701)

2. To prepare a lecture for medical school course in basic medical sciences (1)

   Was preparing a lecture on axonal transport for a basic medical sciences course and wanted information on recent developments in the area of the mechanisms of moving biochemcals up and down the axons (058602)
3. To prepare a lecture for graduate student seminar (1)

Was preparing a seminar for graduate students on colony stimulating factors and needed information on each of the six subclasses in cells and their effects (013903)

4. To provide students with bibliographic materials to aid them in preparing a paper or thesis (2)

Wanted to find references by other groups in the last two years on cardiac assist devices in animal models for a graduate student’s bibliography for her master’s thesis (P10805)

Wanted to obtain review articles on tuberculous meningitis for a third year medical student to aid him in writing a paper on the topic for his oncology service rotation (060403)

B. Practical instruction in a clinical setting (10)

1. To obtain supplemental information pertinent to the care of patients on the teaching services (4)

Had asked resident to give a talk on the condition of a multiple myeloma patient seen on rounds and wanted to be able to elaborate on resident’s talk (P12404)

Wanted information on whether ativam could be effectively administered intramuscularly to control seizures in order to supplement his existing knowledge about treatment of seizures (I) (035404)

2. To provide reference tools for students, residents, or faculty (6)

a. To provide students or residents with selected references or reference list (5)

Wanted to share a particular paper on the malposition of catheter tips with residents to aid them in reading a film of a patient with a chest tube (029102)

Wanted background articles on the ethical issues behind the Harvard criterion for brain death to prepare residents for taking the general internal medicine section of the MKSAP-7 Medical Board Exam (038803)
b. To construct a special-purpose literature data base to provide students or residents immediate access to information on clinical questions (1)

Wanted to create a customized data base to aid residents in searching the journals in the anesthesia department library by downloading appropriate MEDLINE entries to a hypercard file (P10806)

C. Continuing and inservice education of practitioners (29)

1. To obtain information to update practicing physicians on new diagnostic techniques or treatment modalities (18)

Was teaching physicians and technologists from all over the world and needed information on the indications for testing for carotid vascular ultrasound (T06501)

Needed clinical data on use of Beta-HCG as a tumor monitor and also as a monitor of stage of pregnancy for a teaching presentation at clinical pathology conference (U18301)

2. To obtain information to provide inservice education to non-physician health professionals and para-professionals (11)

Was going to be co-teaching and coordinating a class on pain management for nurses and needed literature from the past two years on assessment, narcotics and nonpharmacological treatments such as hypnosis (U05301)

Was preparing a class for nurses on blood administration and needed a search of recent literature to find articles on the physiology relating to blood administration and autologous donations (U05302)

D. Didactic instruction of residents or faculty in a hospital, medical center, or other educational setting (63)

1. To supplement presentation of article in residents' journal club (5)

Wanted to review two major recent studies on use of Levine or peritovenous shunts in treatment of ascites for journal club (P10403)

Was preparing for a lecture for journal club presenting an historical view of vasculitis and needed information on diagnosing vasculitis—the tests and the order in which to use them (052603)
2. To prepare a presentation for a regularly scheduled teaching conference for residents (6)

Was searching for data for a regularly scheduled teaching conference on the effectiveness of various bronchodilators to treat asthma, especially concentrating on aerosolized beta-agonists (T01801)

Was preparing to teach residents and needed information on intraventricular hemorrhages in the delivery of babies—blood in the ventricle of the brain of neonates as the result of birth trauma (I) (U02101)

3. To prepare for case or clinical conference (10)

a. To develop presentation concerning a specific case (7)

Was preparing for a clinical conference on a patient with rhabdomyolysis the breakdown of muscle tissue, and needed information on the natural history of the condition, what is felt to be the cause, and the typical outcome (041602)

Was preparing to present data at a conference and was looking for the treatment for a patient who previously had several heart catheterizations, after a transplant and was now in rejection (T07501)

b. To provide input on specific issue at department conference (3)

Was searching for information for a staff meeting on the effects of lead on the function of the brain and where in the brain the effect occurs (U08103)

Was going to a noon conference at local hospital to discuss primary management of prostate cancer, and wanted to find more information on whether to recommend no treatment (observation only) or surgery and radiation (069703)
4. To prepare a special clinical lecture, symposium, or grand rounds presentation for faculty, residents, and other health professionals (33)

a. To develop content of clinical lecture, symposium, or grand rounds for residents, faculty, or students (28)

Was preparing presentation on chemotherapy of cervical cancer to his division and wanted general information on the chemotherapy of cervical cancer and the relationship of cervical cancer to viral infections (036901)

Was preparing presentation and wanted to know when most research on Crohn's disease and ulcerative colitis had been done (P10402)

Was preparing a talk on sarcoidosis for grand rounds and wanted general reviews of sarcoidosis, including pathophysiology and any reports of abdominal lymphadenopathy (045803)

b. To assemble visual materials to present in clinical lecture or symposium (3)

Was preparing overheads for a presentation on thrombolytic therapy and needed specific statistics on the comparison of the efficacy of streptokinase and TPA so that he could present the most current data (P20201)

Was preparing a talk on keratinization of hair follicle epidermis and wanted pictures of hair follicle epidermis (016401)

c. To locate a specific article or prepare a bibliography to distribute at clinical lecture (2)

Had given a talk to a group of paramedics and nurses on oximetry in pre-hospital settings and had handed out an article for distribution and now needed to locate it because participants had asked for a copy (U13001)

Was preparing to do a seminar on the use of lasers and wanted to be sure there was not any information on an application of lasers that he was not aware of (069601)
5. Presentation of a comprehensive review at a professional meeting (9)

Was preparing a professional talk on transfusions in malignancy and patient survival to give to a national group of physicians on blood systems and wanted background information on the effects of transfusion on survival rates in patients with malignancies (077501)

Was preparing to moderate a symposium on medical liability issues for pathologists and attorneys, and needed to know the specific problems that can arise that lead to litigation or some kind of poor outcome for patient or pathologist (067706)

E. Providing health and safety information to community and lay public (8)

1. To develop a lecture/course on health or safety for lay group (6)

Was doing child safety programs for various community groups and needed updated information on various aspects of safety including burns, bicycles, water, playgrounds, etc. (010502)

Was preparing a talk for a consumers group on children of the survivors of the Holocaust and needed literature on the topic (024502)

2. To answer inquiry from lay public (1)

Received a call from the national office of [youth organization] as to the correct treatment for fire ant bites, so that they could put it into their manual, and needed to find a specific treatment, if one existed, rather than symptomatic treatment (T05802)

3. To present technical information to other pharmaceutical salespeople (1)

Was preparing to give a two-hour presentation on arthritis and [drug] to his fellow drug salespeople at their sales meeting and needed information on arthritis and [drug] (054101)
F. Preparing a written communication on a clinical topic (articles, book chapters, reviews, etc.) (116)

1. To determine whether a disease presentation seen or treatment/procedure used by the physician was sufficiently unique to warrant a written communication (15)

   Was considering writing a paper about treatment the respondent was using use of cimetidine to protect the small intestine and wanted to know whether it was already in the literature (P12001)

   Saw a patient who was in O.R. for electroconvulsive shock therapy for major depressive episodes, who also had uremia. Physician had been unable to produce a seizure and wanted any evidence in the literature of uremia decreasing seizure activity to write the case up because it was such an unusual event (U12502)

2. To obtain an overview of topic area to support preparation of a paper, book chapter, etc. (55)

   a. To obtain comprehensive information on a topic to include in a written communication (30)

      Was preparing a review article on the role of the nurse-consultant in pediatric oncology and wanted all significant and current references (037602)

      Was preparing a book chapter solar urticaria and wanted all significant and current references (P10605)

      Was asked to write a chapter of a textbook on lead poisoning due to retained fragments of material such as bullet fragments (missiles) after having previously published an experimental study, and was looking for more complete information on lead poisoning or intoxication and trauma

   b. To identify current information to update own state of knowledge (25)

      Was writing an article on B-cell lymphoma which was a case report of particular patient who had the life-threatening condition which presented in the skin and needed recent information on the natural history of B-cell lymphoma when it was presented in the skin (028703)
Was writing a paper on coronary spasms and needed up-to-date, current information to write the paper on the relationship between myocardial infarction and coronary spasm (T00101)

Was writing a chapter on echocardiography for description of ventricular inflow anomalies and needed the most recent references on these anomalies (028301)

3. To obtain specific data pertinent to the preparation of a written communication (40)

a. To obtain specific references to support case report on own clinical observations (7)

Was preparing a paper on the use of magnetic resonance imaging (MRI) to diagnose venous thrombosis in pregnant women and was looking for background information on venous thrombosis in pregnancy, and any other reports of similar use of MRI (T02101)

Was writing a paper after conducting a twelve year follow-up of a patient with ameloblastoma who had been treated unconventionally with radiotherapy and wanted information on other pertinent literature that had been published about the use of this treatment for ameloblastoma (032702)

b. To obtain information to answer a specific question arising in the process of preparing an article or book (33)

Was preparing a paper on campylobacter pylori which is a causative agent of chronic gastritis and needed to find cytology procedures—brushings or washings of the gastric mucosa—that could be used to identify the agent (041502)

Was writing a book chapter on anesthesia management of aortic and carotid artery surgery and was looking for information on anesthetic or surgical complications or different anesthetic techniques (I) (P10803)

Was preparing a brief essay on sleep studies in rheumatoid arthritis for a dictionary of the rheumatic diseases and wanted to identify all reports of sleep studies in rheumatic diseases as well as general information on what constitutes a modern sleep study (P21401)
4. To obtain proper bibliographic citations for previously identified articles (6)

- Was preparing a paper or presentation and needed proper bibliographic citation for an article to be included in the bibliography or footnotes (P30702)

- Was writing an article on gastric freezing, which was abandoned after a couple of years because of the complication that patients bled again after a year and was looking for the specific original articles advocating gastric freezing and subsequent articles denouncing it (077901)

IV. Learning (81)

A. Furthering own formal education (15)

1. To obtain information pertinent to preparing paper or other report for graduate coursework (11)

- Was exploring issues of chemical dependency in health professionals for a thesis and wanted information on how different professional organizations and government entities are handling impaired professionals (P11103)

- Was preparing a thesis on developing a measurement tool to assess parents' adjustment to apnea monitoring and needed to know what was already in the literature on sudden infant death syndrome, apnea monitoring, and parents' perceptions of home apnea monitoring (U11002)

2. To obtain information on areas of research interest of individual or laboratory being considered as location for fellowship or sabbatical (4)

- Was planning to do a post-doctoral fellowship and wanted to know if an investigator had a biochemical orientation and studied areas he was interested in, including cytoskeleton and regulation of cell cycle control, before interviewing for the position (051001)

- Was preparing to interview for fellowship and wanted to find out what a researcher, who was investigating neuronal development, had published in the past five years and identify his scientific approaches (051002)
B. Furthering own or other's continuing education (34)

1. To keep up to date in own primary area(s) of expertise (18)

   Was working in the same field as an individual from France and had not seen any recent papers; wanted to find any new papers by him, as well as investigate whether the investigator had changed fields (025203)

   Was researching virulence factors of Neisseria gonorrhea and needed the most recent papers to update his literature file (02701)

2. To evaluate or demonstrate potential of Grateful Med to search literature (6)

   Resident had patient with blood coagulation problem due to protein C deficiency and faculty member wanted to find an article on the topic that he didn't have in his files, as well as to show the resident how quickly he could gain access to information on an unusual clinical problem (070001)

   Had patient with intracranial bleed, on teaching service, and wanted to show residents value of MEDLINE to obtain information when colleagues were unavailable (I) (047902)

3. To prepare for attending a professional conference (3)

   Was preparing a poster presentation and needed information from the abstract of a specific article on the effects of estrogen on glucocorticoid receptor synthesis in the pituitary (P16001)

   Was preparing for conference on cholesteatoma (tumor-like masses) and wanted to review every title in the medical literature on the topic as the pertained to the CNS and Otology (039502)

4. To develop or maintain own database in area of interest (7)

   Was researching anaphylatoxins and needed general information on an analog of the anaphylatoxin C3a (C5a), which plays a major role in the inflammatory response and neutrophil behavior, to build a citation index on own computer (075702)

F-34
Was working on RNA splicing and wanted to develop own database on RNA processing to put all references on Reference Manager program (051401)

C. Satisfying own curiosity or personal interest (32)

1. To learn more about some clinical problem of current interest (16)

Wanted more information about tumor necrosis factor and its relationship to clinical disease and needed a list of current articles and reviews to have a broader knowledge base (T03303)

Was asked about the pathologic features of lymphoblastic lymphoma and needed to know its morphology and to find out how it differs from other lymphomas to satisfy his curiosity; recent references did not provide enough detail (I) (067703)

2. To obtain more complete information on a brief item encountered casually (6)

Wanted to review the work of a researcher not previously known to the respondent (P10902)

Had noted a reference at a talk about work done on hemophilia and wanted to locate the author's article (065704)

3. To develop a more updated C.V. (3)

Wanted to update references for own CV (P10502)

Was preparing CV for promotional purposes and was missing some of own citations and needed all citations on which he was an author (068603)

4. To obtain information on research interests of seminar speakers (7)

Was arranging a chapter meeting of a professional organization and needed to know which surgeons were authorities in ambulatory surgery and who was familiar with the newest developments (U11802)

Was preparing for a visiting speaker and wanted information on the speaker to circulate among staff and to prepare an introduction (072802)
V. Administration (72)

A. Standard setting (34)

1. To obtain information pertinent to determining optimal or most cost-effective treatment regimen (28)

   a. To develop or modify therapeutic protocols (15)

      Was planning a protocol for treatment of premature labor and wanted information on side effects of different beta agonists, particularly terbutaline and aritradine, that are commonly used in this situation (P10703)

      Was preparing to write a departmental protocol for monitoring ototoxicity and needed to know current techniques to detect ototoxicity sooner and the standard dosage regimens to implement to avoid the problem (057101)

   b. To evaluate most efficacious pharmaceutical agent (13)

      Was on hospital Policy and Therapeutics committee, setting standards for emergency medicine, and wanted information on the relative efficacy of streptokinase and TPA (P11301)

      Pharmacy was carrying both triamcinalone inhaler and betamethazone inhaler in the hospital pharmacy and a member of the Pharmacy and Therapeutics committee needed to evaluate which was the more effective and which presented fewer side effects (U06602)

2. To obtain information pertinent to setting standards for use of personnel (2)

   Quality Assurance Committee was questioning use of nurses to triage x-rays and lab work and physician wanted to know what other institutions were doing in this regard (P11302)

   Was administering a public school district's health-related programs and needed articles to defend against cutbacks in nursing staff (I) (T00203)
3. To obtain information on legal issues and liability relative to a particular patient-care policy (1)

Wanted to review national legislation and liability issues related to failure to treat uninsured patients ("patient dumping") (P11303)

4. To obtain information on standards for precautions staff should observe to avoid exposure to possibly harmful agents (3)

Was interested in possible teratogenic effects of ribovirin, an aerosol antiviral agent, on pregnant nurses or on nurses planning to become pregnant who are exposed to the drug when treating patients, and wanted guidelines for protecting health care workers from effects of ribovirin (053603)

Was making recommendations to hospital staff about appropriate precautions for dealing with patients who had methicillin-resistant Staphylococcus aureus infections and needed to know if the infection is airborne, to protect employees from being exposed to the organism when they enter the patient's room (U18501)

B. Evaluation of care (13)

1. To obtain information on national standards against which to compare performance of own institution (7)

Was performing an in-house audit of needle localizations based on mammography and wanted information on national rates of positive findings (malignancies) for this procedure (P12102)

Was doing research on birthweight mortality statistics in own institution and wanted national statistics against which to compare local findings (011203)

2. To obtain measures to assess quality assurance (3)

Was keeping current in field of recreation therapy and needed information on quality assurance and outcome assessment to develop outcome measurements for patient satisfaction and goal attainment (U03301)

Had identified that their ambulatory care quality assurance program needed upgrading and needed methodology and systems to refine plan that would work in a busy, overburdened clinic setting (U04001)
3. To obtain information on possible sources of infection (3)

Had seen several cases of infection by Clostridium difficile, an organism causing antibiotic-associated colitis, and needed recent information about controlling the organism in the hospital to develop quality control measures (U11302)

Was consulting to determine apparent outbreak of an unusual organism, Pseudomonas posimobilus, among bone marrow transplant patients and needed to find out where it might be coming from in the environment, whether it was a real or a pseudoinfection, and whether clinical experience with previous infections had been reported (035101)

C. Planning of facilities and services (11)

1. To obtain information on how to conduct strategic planning (1)

Was developing a strategic plan for the pharmacy department and needed information on strategic planning techniques (044002)

2. To obtain methods for hospital facility planning (2)

Was developing and planning health care for an international agency and needed information on new methods and techniques to help plan a new hospital in Latin America (053901)

Were developing a proposal for a children's hospital for the city service area and needed broad-based information on children's hospitals and on services provided by them (U09502)

3. To help evaluate the rationale for a new facility or service (8)

Was contacted and given a grant to study whether or not HMO should cover pancreatic transplants and needed to assess the benefits and risks and the costs of the service (023602)

Was presenting information about the education or retraining of closed-head injured children and needed to know about a technique called cognitive retraining and whether or not it would be beneficial (T00202)
D. Personnel administration (9)

1. To help evaluate qualifications of a potential employee or colleague (7)

Was asked to look up publications of a candidate interviewing for position of attending physician and needed a list of articles published by the candidate to give to the interviewer (049401)

Was matching expertise of potential reviewers with faculty members up for promotion or tenure for a promotion and tenure process at a college and needed to know areas of expertise in drug research of each potential reviewer (048502)

2. To obtain information to resolve personnel safety issues (2)

Was writing a protocol to ensure the safety of nurses, visitors, and the patient in the period following a surgical implant of a radioisotope, when the patient is radioactive, and needed information on techniques nurses could use to minimize their exposure without compromising care (U19102)

Was writing a paper on precautions health care workers need to take with AIDS patients to protect themselves against infection and wanted to know what percentage of patients who came into the hospital not knowing if they were HIV-positive tested positive for HIV (028402)

E. Equipment purchase (5)

1. To obtain information pertinent to decisions regarding purchase of new equipment (5)

Was considering purchase of a newer blood counting machine and needed to know what the machine measures and what its utility is (I) (030402)

Was planning to go to the surgical staff with recommendations for the use of devices to prevent postoperative respiratory complications and needed to know which device to recommend, how often it should be used, and who should administer it (U04403)
VI. Other (40)

A. Consultation to government agencies (7)

Physician was presenting testimony before congressional committee on appropriateness, quality, and necessity of medical care related to Medicare beneficiaries, and needed information on the impact on quality of care related to prospective payment and DRGs (063001)

Was consulting on the design of a nuclear emergency response plan and wanted published reports of hospital evacuation experiences in other nuclear and non-nuclear emergencies (P20402)

B. Medico-legal consultations (32)

1. To help determine probable etiology of a contested injury or condition (12)

Physician was evaluating the viability of a medico-legal suit which law firm was considering taking on and wanted information on frequency of adverse affects from a vaccine as well as differences between vaccines approved for use in Japan and United States (P12501)

In conjunction with an on-going law suit, wanted information on whether and how trauma accelerates cancer (P12502)

2. To help determine whether prognosis for particular condition was affected by delayed or incorrect diagnosis (5)

Was consulting to a lawyer on a medical liability case and needed outcomes and survival rates in cryptococcus infection with proper diagnosis and early treatment as compared with late diagnosis and treatment to make certain that no support existed in the literature for the claim that the outcome would be deleterious whether or not the disease was treated early or late (021101)

Was consulting on medical-legal cases related to the issue of misdiagnosis of aneurysm and wanted clues for early diagnosis, outcomes after correct diagnosis and proper treatment, and statistics on survival to counter claims that early diagnosis would not have made a difference (021102)
3. To obtain information to determine the appropriateness of care given (12)

A physician was having a problem with other physicians at his hospital because of a new technique he was using for hiatus hernia surgery; another physician who was assisting prepare the defense wanted information on most current indications for surgery and surgical techniques (P12503)

Dermatologist was consulting on alleged malpractice in treatment of basal cell carcinoma and needed information on established standard of care as of the date of the contested event (1977), which predated the physician's own training (019602)

4. To obtain information to assess future risk of a serious, life-threatening problem due to some agent (2)

Was evaluating a case of a patient who had been exposed to the sun on the job and had developed actinic keratoses; needed information about the likelihood that actinic keratoses will develop into skin cancer for purposes of providing the worker's compensation company with accurate, up-to-date information (027602)

Physician was asked for information about a reported fatal anaphylactic reaction to carbonless paper and needed information about any type of toxicity to such paper for and whether diisocyanate, which is converted to a monoisocyanate and aerosolized at the end of the papermaking process, can lead to a lethal reaction (034902)

5. To obtain information to aid in resolving a personal medico-legal matter (1)

Had a court hearing scheduled and needed background information about behavior patterns in vicious dogs to resolve a personal problem with a vicious dog in the neighborhood (I) (T00402)

C. Personal business endeavors (1)

Wanted information on anabolic steroid implants for weight gain in cattle to aid in his business (I) (043403)
APPENDIX G

IMPACT OF THE INFORMATION OBTAINED FROM MEDLINE ON MEDICAL DECISION-MAKING
I. Patient Care (476)*

A. Used the most appropriate diagnostic test (34)

1. Used a previously unknown or unavailable diagnostic test or procedure (6)

   Identification of a new technique for measuring diastolic blood flow (carotid ultrasonography) enabled physician to recommend that this test be ordered to investigate (and eventually rule out) possible arterial problem (internal carotid aneurism) without risky, painful, and expensive arteriogram. (034901)

   Information on antiphospholipid antibodies, anticoagulation therapy for patients with this life-threatening condition, and how to obtain the necessary laboratory test enabled physician to confirm suspected diagnosis of this problem in a young stroke victim and to place her on anticoagulant medication. (Patient is still in hospital with a fair prognosis.) (010801)

2. Used the most sensitive and specific diagnostic test(s) or workup for suspected condition (12)

   Information indicating a high false-negative rate of ultrasound for common duct gallstones and that GGT was the most helpful blood test for this problem led physician to request immediate GGT on patient with a negative ultrasound scan but one blood test suggestive of such gallstones, which resulted in the diagnosis, subsequently confirmed by other tests. (Stone detached itself prior to surgery and patient is fine.) (011404)

*Number in parentheses are the numbers of incidents classified in each category
Absence of information on any new measures for differentiating between schizophrenia and organic brain disease resulted in psychologist’s continued use of Bender Gestalt test as a diagnostic measure, even though there is a controversy over its validity, in patients for whom he is called in as a consultant. (I) (U08702)

3. **Performed or interpreted diagnostic test properly (9)**

   Information giving the radiographic appearance of otitis externa enabled pathologist to decide that image was indicative of a tumor rather than otitis externa and to request further imaging to confirm this diagnosis. (Patient would have had surgery if diagnosis was confirmed.) (038303)

   Pathologist had patient with thymoma cells in the pleural fluid who had an inconclusive biopsy. Information from cell marker studies on the differing cell patterns of benign and malignant cells enabled the pathologist to discern that the biopsied cells were malignant, after which the clinicians decided to treat the patient’s breathing problems and to treat the patient with radiation and chemotherapy. (Patient’s current status and prognosis were unknown to the pathologist.) (039901)

4. **Evaluated new laboratory test for adoption (3)**

   Information on the specifics of a method to measure xanthine oxidase in the serum, to assess the degree of hypoxia in newborns who were asphyxiated at birth and then resuscitated, enabled the physician to choose a more accurate test that hospital laboratory could offer. (U13903)

   Information on the specificity of the beta 2-microglobulin test to evaluate the condition of AIDS patients enabled clinic staff to decide to not use the microglobulin test to evaluate patients with AIDS. (074503)
5. Identified most appropriate test and where it could be performed (4)

Information on the specifics of a diagnostic technique (radionuclide lymph angiography) and on lymph edema enabled physician to adopt this technique at his institution to examine cases of edema and to provide clinicians with rough parameters for evaluation -- diagnosis of lymph vs. vascular causes of edema and for monitoring and post-op follow-up in, e.g., lymphovenous anastomosis procedures. (040002)

Information about clues for diagnosing ectopic pregnancies and about additional tests such as coloocentesisis and endovaginal ultrasound to fine-tune the diagnosis enabled physician to diagnose one ectopic pregnancy that he might have missed otherwise and to reduce his anxiety. (016301)

B. Recognized and properly diagnosed a medical problem or condition (104)

1. Recognized existence of an abnormal or normal condition (15)

a. Determined that an observed condition was within the normal range (1)

Identification of information on the range of benign myoclonus in the newborn convinced the physician that the baby he observed in the hospital who jerked in response to touch, had episodes of apnea, and had a familial history of the same condition did not have a life-threatening condition but was within the normal range. (058001)

b. Determined that problem was a recognized clinical entity (12)

Information obtained validated physician's hypothesis that he was dealing with and appropriately treating a
legitimate clinical entity (thyroid abscess) in patient with polyarteritis nodosa who had developed sepsis after a consulting M.D. thought he had experienced a thyroid hemorrhage, and it also identified treatments that had been used by others. (T02001)

Information obtained on depression, treatment of depression, and client safety confirmed that the plan that the physician had formulated was correct and allowed him to treat patient in a more confident manner. (024501)

c. Determined that proper diagnosis required referral to a(nother) specialist (2)

Information on blepharospasm (involuntary blinking of the eyelid) and the fact that it can be aggravated by psychological factors convinced the psychiatrist to refer his patient, who was a referral from the Workman’s Compensation insurance company, to a neuro-ophthalmologist for further evaluation and testing. (U17202)

Lack of confirming information that thrombophlebitis was a side effect of the anticonvulsant Tegretol led physician to go to the drug company for information (which confirmed the side effect) and to withdraw use of all medications and to treat patient’s thrombophlebitis. (I) (U08603)

2. Arrived at a differential diagnosis (89)

a. Identified the diagnostic and prognostic implications of specific history, physical exam, or test results (10)

Pathologist examining supposed "wart" that he concluded was malignant used information he obtained on classification, treatment, and prognosis of that type of
skin cancer (polypoid melanoma) to alert and inform the surgeon, who the pathologist believed may not have been familiar with the problem and its treatment. (034001)

Data indicating that patients with a certain unusual pattern of tumor markers for myeloid leukemia had a very poor chance for long-term cure provided the basis for physician’s decision to proceed with a bone marrow transplant for a patient who exhibited this pattern, and led to a decision by the hospital tumor board to test for these tumor markers in all children who have a similar presentation. (Patient is waiting for a transplant.) (059902)

b. Considered possible diagnoses that would otherwise have been overlooked (6)

Information indicating that upper lobe bullous disease could be caused by several conditions other than emphysema or cysts (notably tuberculosis, ankylosing spondylitis, pneumocystis pneumonia, and IV drug use) led physician to consider these diagnoses in a young patient who didn’t describe a history of drug use. Physician also now suggests these differential diagnoses to physicians referring patients with this problem. (029101)

Two case reports of headache and migraine-like visual phenomena related to lead exposure were the basis for physician’s confirmation of lead exposure as the cause of patient’s having these unusual symptoms. Physician recommended classic treatment for lead exposure, which is chelation therapy. (Patient received chelation therapy and her symptoms cleared in about 3 weeks.) (048103)
c. Eliminated or was helped in eliminating a possible diagnosis/cause of a medical problem (17)

Failure to find any reports of exercise-induced pancreatitis helped physician rule this out as a cause of pancreatitis in an adolescent patient who collapsed during a foot race. Having ruled out other causes as well (infections, gallstones, alcoholism), physician treated patient by withholding food until pancreas could rest and was able to allow patient to resume racing with no recurrence of inflammation. (011401)

Absence of information supporting a relationship between optic symptoms and exposure to an herbicide (2,4-D) led consulting physician to conclude that 2,4-D exposure was probably not the cause of optic neuritis in a patient, and to advise clinician to treat the neuritis as another type of problem, such as multiple sclerosis. (Patient received local treatment with cortisone and recovered with no decreased vision.) (048101)

d. Reached a diagnosis by resolving apparently conflicting laboratory results, physical exam findings, or history (6)

Information confirmed physician's hypothesis that patient's hematuria was due to taking Quaaludes and enabled him to advise patient that hematuria would go away if she stopped taking the drug, which appears to have occurred. (021201)

Information indicating that positive radiological findings had been previously observed in at least two cases of bone marrow disease resolved apparently inconsistent radiological and histological
findings and made it easier to diagnose bone marrow disease.  (034003)

e. Arrived at a diagnosis despite impossibility of obtaining the classical diagnostic information (2)

Information indicating that Down's syndrome has been observed to be associated with leukemia in newborns increased pathologist's confidence in the diagnosis of Down's syndrome at autopsy on a stillbirth based on evidence of congenital leukemia, even though no cells could be cultured for a chromosome study, and enabled appropriate counseling of the parents. (036103)

Lack of case reports in the literature of other examples of chronic lymphocytic leukemia in very young children, did not allow the physician to confirm the diagnosis in his patient. Treatment was unaffected as patient later developed other definitive symptoms and physician was doing a retrospective analysis. (I) (065802)

f. Avoided a premature or unjustifiable diagnostic conclusion (14)

Absence of comparable case reports in literature of flexeril overdose in children told physician he was facing an unusual situation and helped avoid a premature conclusion about the cause of child's neurological problems. (T01301)

Determination that there was only a single report that a particular pattern in bone scans was associated with Paget's disease, and that there was no further information on the pattern's specificity for the diagnosis, helped keep physician from being too dogmatic about the specificity of a similar pattern he had
observed for Paget’s as opposed to bone metastases. (040001)

**g. Confirmed the suspected cause of a diagnosed medical problem (27)**

Information on the description of capsular leiomyomas confirmed physician’s suspected diagnosis in a patient where this unusual kidney tumor was discovered after surgery for another, larger tumor. In fact, the tumor was benign and no further therapy was needed. (U11502)

Information about the incidence of bilaterality of seminomas (primary germ cell tumors of the testes) confirmed pathologist’s belief that patient’s presentation, after 10 years, with a second separate seminoma on the other side was a second primary lesion, not a metastasis. This meant that the urologist would follow-up patients with a single lesion up to 10 years and that the treatment plan for this particular patient would be altered to reduce the amount of radiotherapy since the field had not been irradiated before. (U06901)

Lack of information about mortality statistics for specific types of meningitis with different etiologic agents left pathologist with unanswered questions about the cause of death for a patient seen in autopsy because he could never obtain any culture confirmation of a specific virus. (I) (U06902)

**h. Confirmed a casual clinical observation about the possible association of particular signs/symptoms, leading to adoption of diagnostic procedures to identify appropriate management in such instances (7)**

Information indicating that there is a linkage between thyroid problems and
depression, and that lithium for bipolar depression can depress thyroid function, confirmed physician's casual clinical observations and led him to begin to test thyroid function more carefully in depressed patients and to treat both the depression and any thyroid problems simultaneously. (010403)

Information on psychogenic polydipsia in psychotic patients helped psychiatrist realize that polydipsia among psychotic patients is quite prevalent nationally, not merely a local problem, and led psychiatrist to institute procedures to restrict fluid intake on the wards and set up a schedule to monitor electrolyte levels. (U08602)

C. Developed an appropriate treatment plan (216)

1. Confirmed the appropriateness of therapy selected to treat a particular problem (24)

   a. Confirmed that the original treatment plan was correct (10)

   Information indicating that the only treatment for severe myasthenia gravis was steroids and/or Imuran along with acetylcholine drugs made the physician feel confident that his original treatment plan for his patient was correct. (U02802)

   Lack of information on World Health Organization guidelines for the administration of BCG vaccine for tuberculosis prevention at birth to all third world children did not allow physician to provide the guidelines to persons who wanted to provide the vaccine for villages in Mexico. Physician later obtained WHO guidelines at a conference and found out from a Mexican physician that the guidelines
were being used and the vaccine was being provided. (I) (011402)

b. **Confirmed efficacy of usual treatment after exploring alternatives (8)**

Information on what detoxification protocols were in use (for benzodiazepine addiction), and the fact that there were none that could reduce the time required, resolved controversy in institution regarding time required by protocol currently being used. (033601)

Information obtained about new vaccines being developed in other countries and vaccine failures made the family practice physician more confident that he should prescribe the standard treatment (HDCV vaccine) rather than continue what had been started in a foreign country for patient who had begun rabies immunization in Mexico and then returned to the U.S. (045301)

c. **Obtained support for proposed treatment of rare/unusual condition (4)**

Information obtained on the use of intravenous IGG and steroids to treat neutropenia, which is a rare and life-threatening condition, supported the physician's decision to use this treatment, which he had only heard about anecdotally, on his patient with the condition. (040801)

Information obtained on the use of cyclosporine and other unusual treatments for aplastic anemia, a rather rare and serious disease, helped physician learn that nothing more could be done for the patient. Physician put the patient on GM355 protocol because all other protocols were anecdotal. (011401)
d. Decided against a proposed therapy for lack of supporting evidence (2)

Evidence that there is a lack of understanding about extreme proteinuria, except that patients usually die within 5 months, and a lack of evidence that AZT treatment would help this kidney problem, led physician to decide not to use AZT to treat patient with extreme proteinuria and HIV infection. (Patient has stayed alive for 2 1/2 years in spite of proteinuria.) (039603)

Advice obtained from the literature to not use any nerve block for temporomandibular joint (TMJ) pain helped anesthesiologist decide to continue with oral pain medications, psychological counseling, and tricyclic antidepressants rather than initiate use of any nerve block (044803)

2. Identified, evaluated, and chose an alternative to own approach to treatment of a problem (35)

a. Identified and implemented a new (state-of-the-art) treatment regimen (5)

Information in a Swiss journal indicating that there was a new treatment for aplastic anemia--high-dose antithymocyte globulin and high-dose prednisone--convinced the physician to plan to use it on his patient. (P10301)

Physician was unable to retrieve the latest information on diagnosis and treatment of thrombocytopenia, a bleeding disorder, but was able to treat patient. (f) (045202)
b. Identified other treatment options among which to choose (12)

Information about lack of expected benefits from use of a pain control technique (transcutaneous electrical nerve stimulation) and use of the technique for acute postoperative pain was provided by anesthesiologist to a colleague who had requested information describing the technique and its uses. (Anesthesiologist is unsure if colleague has begun use of the technique.) (044802)

Consistent reports recommending the removal of an infected pacemaker confirmed physician’s decision not to use antibiotic treatment for a patient with an infected pacemaker but to remove the pacemaker and implant a new one. (065502)

c. Changed the management of a common condition (2)

Information obtained by surgeon on current trends in rehabilitation after total hip replacement, which recommended a posterior surgical approach and a six-week recovery period before full weight-bearing ambulation, caused him to institute these new methods with his patients. (066303)

Information suggesting the use of inhalation treatment with bronchodilators for emergency treatment of children with asthma, as well as use of steroids with this population, resulted in physician changing his management of these patients when they present in the E.R. (U14401)
d. Confirmed the efficacy of a more conservative therapeutic approach (7)

Information obtained by a physician that adrenal masses could be evaluated over time, rather than surgically removed, supported the physician’s conservative approach in controversy with another physician. The patient was evaluated biochemically and surgery was avoided. (068502)

Information obtained about treating shoulder-hand syndrome in stroke patients reinforced physical therapist’s position that immobilization with a sling was not the first choice and that a gentle range of motion and positioning was preferable. (U14601)

e. Chose to implement a more aggressive therapeutic approach (2)

Identification of a more aggressive treatment regimen for advanced colon cancer (cisplatin for 5 days and intra-arterial mitoxantrone) allowed the physician to show the printout to the patient and family to confirm that this was the best treatment available. Family felt no need to seek other opinions and the patient accepted the therapy. (U19401)

Identification of intensive antibiotic injections around the eye as a treatment for pseudomonas scleritis, a rare infection usually resulting in the loss of the eye, helped ophthalmologist choose this more aggressive treatment for patient and improve the patient’s vision. (030101)
f. Chose an appropriate alternative treatment for a rare, unusual condition (7)

Identification of evidence that supported the physician's view that his patient should have a colectomy allowed the physician to make a treatment recommendation to a patient with a unique presentation of multiple colonic polyps. The type of polyps and their distribution was so unusual that, prior to the search, the physician was not certain, from his knowledge or his textbooks, of the appropriate treatment. (U00902)

Identification of the best therapy involving surgery and chemotherapy helped gynecological oncologist choose best therapeutic solution for patient with rare variety of ovarian carcinoma. (047001)

3. Adjusted the proposed therapy to improve effectiveness (11)

a. Chose the appropriate dosage of a drug that had previously been selected (2)

Information on the correct dosage of mitotane and OPDD to treat adrenocortical cancer (not commonly used drugs) was used to treat patient with this disease. (019401)

Information about the proper dosage of fentanyl for use as an anesthetic in surgery involving premature infants confirmed the appropriate choice of dosage of drug used by the anesthesiologist for child requiring surgery to close ductus arteriosus. (033802)
b. Identified a new route of administration for a known drug (6)

Identification of a different route for administering Ivermectines allowed a veterinarian to better treat ear mites in cats. Instead of the old tedious and usually unsuccessful method of applying the medication topically, he found evidence for injecting the drug, so the animal is treated once and is cured of the problem. (043401)

Information about combining sodium bicarbonate with a xylocaine in the same solution to reduce the pain associated with giving the local anesthetic enabled pharmacist to answer physician’s question, which then allowed physician to make the treatment less painful for the patient. (059701)

c. Chose a different dosage/régimen to yield a better response (3)

Information obtained on a different treatment regimen convinced the physician to change the way he treated a patient with chronic scrotal and lower-extremity edema caused by treatment for a bladder tumor 10 years before. From the literature on female patients with similar symptoms after radical pelvic surgery, physician learned that, by giving a low-dose nightly antibiotic (until the symptoms disappeared) instead of high doses for only a week, he could alleviate the patient’s problems. (U15104)

Information about how non-steroidal anti-inflammatory drugs prolong the bleeding times associated with coumadin treatment led physician to do a more detailed history-taking of patients who were to have vascular bypass surgery or resection for aneurysms and to manage
4. Selected a treatment plan appropriate to condition of individual patient (51)

a. Chose therapy appropriate to patient’s age (13)

Information on guidelines for length of antibiotic use led physician to continue treatment for an infant with salmonella gastroenteritis bacteremia longer than he otherwise would have and increased physician’s certainty that what he was doing was current therapy. (012101)

Successful retrieval of an article that physician had previously read about treatment of herpes zoster with acyclovir, which described results for treatment of patients who were older than current 30-year-old patient, led physician to decide against use of acyclovir for this patient and to prescribe prednisone instead. (011403)

b. Chose therapy appropriate to pregnant patient (8)

Information on the likelihood of a recurrence of thrombosis in a current or subsequent pregnancy, how long and how intensively to keep patient on heparin therapy, and absence of evidence of any attempts to use clot dissolvers during pregnancy led physician to decide against thrombolytic therapy during pregnancy and to more fully heparinize pregnant Hodgkin’s patient, who had a venous thrombosis due to an indwelling catheter, between than during her pregnancies. (011202)

Data that indicated that treatment of seizures with valproic acid is associated with a 1% incidence of fetal anomalies confirmed physician’s suspicion that the
drug should not be used to treat a pregnant patient with seizures. Physician stopped valproic acid and switched patient to Dilantin. (011201)

c. Chose appropriate therapy in light of patient's previous history (12)

Descriptions of clinical trials of low-molecular-weight heparin derivatives that can be substituted for heparin, and of sources for obtaining these derivatives, enabled physician consulting to a surgeon with a patient with a life-threatening allergic reaction to heparin to advise the surgeon on how to use these heparin derivatives and where to obtain them. (Bone marrow service also was able to establish a route for obtaining these derivatives within 10-12 hours.) (059901)

Information indicating that gamma globulin is contraindicated in patients with low IGa levels, as opposed to those who are IGa absent, enabled primary care physician to convince pulmonary specialist to take patient off this preparation and simply treat patient's underlying respiratory infection problems, thus decreasing the patient's risk of crossmatch problems were the patient to ever require surgery. (It also resulted in patient having her children tested for this possibly hereditary disorder.) (010401)

d. Chose appropriate therapy in light of a concurrent medical problem (12)

Information on existence of a new short-term, non-steroidal treatment strategy for managing arthritis (T-cell globulin fractions), of which physician had been unaware, enabled physician to obtain and use the medication, which
allowed earlier surgery on a bleeding ulcer caused by the steroids a patient had been taking, and allowed an earlier switch to the more effective non-steroidal treatment of choice for the patient (methotrexate) (010901)

Information about connections between skin changes from psoriasis (arthritic changes) enabled physician to conclude that there may be a relationship between severe acne and lower back and joint pains and to treat both conditions with corticosteroids (U03901)

e. Chose the correct regimen for multiple disorders (6)

Case reports of treatment of patients with temporal arteritis and scleroderma with steroids, which is the standard treatment for temporal arteritis alone, provided basis for physician's decision to treat a patient with this rare and life-threatening combination of diseases with steroids. (031203)

The very limited number of reports of other cases of two concurrent diseases (myeloproliferative disease and chronic lymphocytic leukemia) led physician to elect to proceed with his planned treatment of both diseases. This also enabled him to tell patient that condition was rare but not unique. (038704)

5. Minimized risks of treatment (60)

a. Determined whether there was evidence of risk or side effect associated with planned treatment (20)

No information was obtained suggesting a high probability that cyclosporine would cause a thrombosis in the renal artery after a kidney transplant. Physician was then able to tell the family
that it was unlikely to happen again in a patient who had lost a transplanted kidney once because the renal artery clotted off. (029502)

Rheumatologist found references on methotrexate therapy for cancer patients at 50 times the dose being given to an arthritis patient who had developed acute hepatitis, in which the drug was reported to cause hepatitis, but without liver damage, and the effect disappeared within a few days. He reported to the patient’s general practitioner that the hepatitis was probably not caused by the methotrexate and that other causes should be explored. (052604)

Evidence that the use of angiotensin-converting enzyme inhibitors might actually make asthma worse or cause it in borderline asthmatics convinced physician that these drugs would not be an appropriate alternative to beta blockers for treatment of asthmatic patients who were also hypertensive. (022601)

b. **Selected therapy that would minimize potential side effects/risk/other adverse effects of treatment (15)**

Data provided in the literature by the inventor of a blood filter for pulmonary emboli, indicating that it caused chronic obstruction of the vena cava in a significant proportion of patients, was basis for physician’s decision not to insert the device in a pregnant patient as a substitute for heparin therapy for suspected pulmonary emboli. Decision was made to stop heparin during C-section and start heparin again after bleeding stopped. (015601)

Identification of a surgical specialist who could excise an endothelial sarcoma near...
the sacrum but spare the associated limb by performing a bone replacement enabled physician to refer patient with this sarcoma to the specialist, who performed surgery after patient had several rounds of chemotherapy. (034905)

c. Provided treatment for anticipated or potential problem (8)

Failure to locate reference to an article physician had seen in pediatric journal prevented physician from obtaining an expert’s comment on the article and obtaining his opinion of the feeding position for an infant (bottle propping) in order to reduce accumulation of fluid in the middle ear and risk of serous otitis media. (I) (012601)

Information on a particular tumor (pheochromocytoma), medications that could exacerbate it, and the best pharmacological preparation of the patient before surgery helped physician to diagnose the problem, begin to prepare patient sooner than he otherwise could have, and helped keep the patient out of trouble. (Also, authenticity of information via MEDLINE helped convince physician’s colleagues that this approach was warranted.) (035001)

d. Identified ineffective or risky treatments for a medical problem (includes fads, notions, homeopathic remedies, etc.) (17)

Information stating that fish oil can be an allergic provoker of migraine headaches led physician to discount anecdotal reports that fish oil could be used as a treatment for migraine, and to decide not to use it as a treatment for himself or patients. (051802)
General information about kidney stones and about specific therapies for them, including the recommendation to avoid drinking large quantities of milk, led psychoanalyst who was searching for information and guidance about his own condition to stop drinking large quantities of milk, to decide against invasive therapies, and to feel relieved that he was more in control due to a better understanding of his condition. (038401)

6. **Determined limits of own capacity to manage patient's problem and need for specialized care (35)**

   a. **Identified appropriate treatment for a rare condition that the physician (specialist) had not previously treated (10)**

      Identification of a chemotherapy regimen that had been relatively more successful in a previous trial with a small number of patients enabled physician to initiate treatment of a rare cancer (invasive thymoma) that he had not previously treated. (034601)

      Information indicating that the most successful treatment for cancer that had metastasized to the orbit of the eye was DES therapy enabled physician to choose this therapy for patient as a sequel to previously-treated prostate cancer. (034201)

   b. **Determined the need to seek further information from another source (8)**

      Inability of dentist to obtain any information about treatment of an unusual lower jaw tumor (intrabony neurofibroma of the mandible) resulted in dentist having to locate this information in the most recent issue of a journal he receives. Dentist then used
the recommended treatment for his patient. (I) (032703)

Determination that there were no previous reports of such an occurrence led physician to seek advice from neurosurgeons on how to manage patient with blood in the intrathecal/subdural space due to inadvertent injection in the course of an epidural blood patch. (Physician elected to observe and not treat.) (011301)

c. Made a decision that patient should be referred to specialist for management (12)

Information on the characteristics of craniofacial anomalies and lissencephalies reported, showing no established relationship between them, led physician to diagnose craniofacial anomaly of unknown type in a child with an unusual presentation of craniosynostosis and to refer the patient to a craniofacial center. (018201)

Because no information about chemotherapy protocols suitable for a metastasized advanced bladder cancer could be found, physician decided to transfer patient with this condition to a tertiary care center. (Patient was transferred; outcome unknown.) (014401)

d. Identified and used new procedure that surgeon had not previously used (5)

Recent literature on treatment of a hemangiopericytoma gave physician a clue on how to proceed with resection of the tumor and much of the septum and fix it with a prosthesis, and will enable him to use radiotherapy on it if there is too much intracranial spread. (030601)
Information found was not specific enough for a physician to undertake a third ventriculostomy for internal treatment of a patient with hydrocephalus. The physician had not performed the procedure before and did not find enough information to give him support that the benefits would outweigh the length and risk of surgery. Instead the patient was treated with the standard shunting procedure. (1) (U01201)

D. Implemented treatment plan (67)

1. Instituted prompt treatment of problem (8)

a. Began treatment earlier than would otherwise have been possible (3)

Identification of information on the current recommendations for treatment of chancroid in the emergency room allowed the physician to rapidly set up a policy for treatment of the condition in response to an epidemic of chancroid in women presenting in the E.R. of his hospital and to pass along the policy rapidly to the E.R. personnel. (T00702)

Information on the potential toxic effects of exposure to a chemical (a polymer of diisocyanate) involved in the production of carbonless paper resulted in the workers at the end of the production line being required to wear respirators, as well as more careful monitoring of the ambient air on the production line by industrial hygiene personnel. (034902)

b. Chose the correct priority for treatment(s) in an emergency situation (5)

Discovery of two articles on a similar situation was key to physician's decision to concentrate on reversing anaphylaxis in critically ill patient, rather than attempting primary treatment of concurrent cardiac failure, and was
probably critical to the patient’s survival. (039602)

Discovery of articles verified oncologist’s suspicion that etoposide was the drug of choice as a salvage regimen to treat a patient who had a germ cell cancer that had not responded to the standard treatment, but that if the tumor was still growing at the time of the last etoposide treatment, then the prognosis was poor. Physician contacted a colleague at NCI to identify more experimental treatments. (057201)

2. Provided appropriate monitoring of patient’s condition (12)

a. Identified early symptoms indicative of a recurrence or exacerbation of a problem (4)

Absence of indications that there were any new techniques for serodiagnosis, plus information reviewing the potential complications of Behcet’s syndrome, reinforced physician’s diagnostic procedures, enabled him to educate patient, and will decrease the likelihood of complications by alerting both to symptoms earlier than they otherwise would have been detected. (036301)

Information obtained by physician assistant on two specific tests—prothrombin time and partial prothromboplastin time—for disseminated intravascular coagulation (DIC), which is an infrequent complication of orthopedic surgery, resulted in the institution of monitoring techniques to detect DIC earlier and informed physician assistant on how frequently the tests should be performed. (T00802)
b. Determined the appropriate method and frequency of monitoring for potential side effects of treatment (8)

Information on a drug used to treat rheumatoid arthritis (methotrexate) suggested a range of points to monitor for potential liver damage, but indicated there was no clear consensus on optimal frequency of monitoring or dose at which a biopsy should be done. This encouraged physician to begin prescribing methotrexate to several patients and guided him in formulating instructions to patients about schedules for follow-ups to monitor side effects. (011102)

Case reports of other occurrences of breakage and fragmentation of indwelling central venous (Hickman) catheters, and descriptions of mechanism involved, was used by physician who observed such breakage in one patient to institute a monitoring procedure to check for signs of breakage in other patients and to accumulate data on percent breakage in such patients in his institution for possible publication. (029103)

3. Evaluated and revised treatment plan as needed (47)

a. Identified a promising new treatment or variation when other options had proven ineffective (16)

Information covering all current treatment regimens for lymphoblastic lymphoma enabled physician to choose and initiate an aggressive treatment with a better prognosis (CHOP followed by a round of another chemotherapeutic agent) for a patient with this rare cancer. (040201)
Identification of a promising chemotherapy protocol for metastatic thyroid cancer (adriamycin and cis-platinum), not previously known to the physician, gave the physician an additional option to try for a disease for which there was no standard treatment. (049903)

b. Utilized a promising therapeutic agent not readily available in U.S. (3)

Information of the identity of companies distributing a particular chemotherapy agent in Europe (prednimustine) enabled physician to obtain this drug in the U.S. and use it to treat a Hodgkin's patient who had relapsed while on another therapy. (037402)

Information obtained by pediatric fellow on the use of 4-methyl pyrazole, a drug which has been used for treatment of ethylene glycol poisoning but has not yet been licensed in the U.S., will result in his possibly recommending this treatment for this type of poisoning next time he is consulted. (066701)

c. Chose a new treatment option when necessary, taking into account contraindications due to patient's condition (8)

Identification of two potential chemotherapies for Hodgkin's disease that are not too toxic for patients who have been heavily pretreated has given physician and patient an option that may be helpful and not too disruptive to the life of a Hodgkin's patient with an incurable condition. (037401)

Information about chronic pain associated with intestinal problems and medications to manage chronic pain (tricyclic antidepressants), allowed social worker to provide the information to
patient and physician, so both could understand the condition better and the physician could prescribe the tricyclics (U07403)

d. **Insured that all possible treatment options were explored in the case of a seriously disabling or life-threatening condition (19)**

Case reports of patients that had done well with just long term antibiotic therapy enabled physician to successfully treat a post-surgical bone infection (pudendal osteomyelitis) without further surgical intervention. (035102)

Identification of the best therapy (intravenous miconazole) for a brain abscess due to a very rare fungus, based on a limited number of previous case reports, was critical to the physician being able to institute the correct treatment, without which the patient would have died. (035002)

e. **Determined nature and extent of others’ previous experience with own improvised therapy (1)**

Information was obtained which identified that a highly unusual procedure which the surgeon had improvised had been reported one other time in the literature. When the surgeon was unable to plug the renal vein into the iliac vein of the patient, he plugged it into the portal vein. It was helpful to the physician to know the operation had been done before (only once), but since the operation was not too successful (the kidney clotted off two days later), the physician decided not to write up the case. (T04101)
E. Maintained an effective physician-patient relationship (46)

1. Provided explanation of condition to patient or family (44)
   a. Relieved patient or family anxiety (30)

   Information indicating that the effect of pregnancy on malignant melanoma is not well understood, but appears to depend on how advanced the case is, enabled physician to provide the best available answers and reassure newly pregnant patient. Patient had had a malignancy several years previous and had become highly anxious after discovering a suspicious lesion (which proved not to be a melanoma). (P31101)

   Information indicating that Thorotrast, an X-ray contrast medium, removed from the market fifteen years earlier, caused reactive thickening of meninges and produced neuritis allowed physician to explain the cause of the condition to patient and to explain that nothing can be done except to use painkillers to help the neuritis. (033301)

   Lack of information on prognosis of a rare skin disease (bullous pemphigoid) characterized by bullous lesions and skin necrosis, prevented physician from answering patient's family's questions promptly and necessitated calls to academic medical centers to obtain the answers. (I) (071602)

b. Improved patient or family cooperation (3)

   Data that indicated that the 5-year survival rate for nasopharyngeal cancer varied from 20 to 90% depending on the type and stage of the tumor guided physician to counsel members of his family to be realistic about the prognosis for another family member with this
c. Involved patient or family in treatment decision (11)

Information on the types of associated birth defects enabled physician to counsel parents of a child with a chromosome deletion that child would have mild mental retardation and should be enrolled in an infant stimulation program. (015001)

Information recommending vaginal delivery after Caesarean (VDAC), the appropriate monitoring techniques, and patients who should be ruled out, made rural physician more accepting of the new practice but led him to suggest to patients who want VDAC that they will be referred to an urban clinic or hospital with the appropriate emergency equipment (016303)

2. Insured continuity of care for patient moving or traveling outside area (2)

Information obtained by a physician with a pancreatic cancer patient undergoing chemotherapy permitted him to recommend a specialist to continue her care in city to which she was moving for the winter. (040802)
Information on chemotherapy and immunologic protocols and persons performing limb-sparing surgery for soft-tissue sarcomas permitted oncologist to recommend the only specialist performing limb-sparing surgery to a patient with an endothelial cell sarcoma. Patient was treated by that specialist, had the sarcoma removed, and is now walking. (034905)

F. Provided assistance in modifying patients' health behaviors (4)

Failure to obtain information on effective interventions and educational resources to help patients stop smoking, reduce cholesterol, and increase exercise prevented physician from preparing a booklet for other doctors in his office to help them answer patients' questions and assist patients in making changes in health risk behaviors. (I) (010902)

Information obtained by endocrinologist showing that lowering cholesterol lowers the incidence of heart disease but does not lower the death rate from the disease, coupled with his discussions with experts in the field who also lacked proof of the benefits of lowering cholesterol, has significantly affected his patient care. Physician does not say that he has evidence that it matters if they lower their cholesterol; he says that he believes that there are benefits. (U06302)

G. Discharged responsibilities with respect to patient and third-party payors (5)

Determination that there was only one, inconclusive report of a low blood count resulting from any of the chemicals to which the patient was exposed on his job led physician to conclude that patient's work environment was safe, to deny support for workman’s compensation claim, and to institute typical therapy for idiopathic thrombocytopenic purpura. (038703)

Information indicating that remission of a particular kidney disease (membrano-proliferative glomerulonephritis) is rare and that it normally recurs supported physician's decision not to certify to patient's insurance company that patient, who had

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been in remission for several years, no longer had the disease, as had been requested by patient’s mother. (040203)

II. Research (239)

A. Formulated a research problem or hypothesis (64)

1. Determined whether research area was viable (12)

Researcher who knew that rheumatoid arthritis, which is hereditary, is identified with HLA type 27 hypothesized that there might also be a relationship between atherosclerosis and HLA-typing. He thought this might be worth pursuing as a research project, but when he couldn’t find anything in the literature relating atherosclerosis and HLA-typing, he decided not to pursue it further (053701)

Research team of molecular biologists working in large animal studies had isolated maternally-produced retinal-binding proteins in pig uteruses. These proteins were not fully loaded, and team was interested in exploring whether loading status influences embryonic survival. To substantiate the viability of this research idea, they were looking for evidence in the literature that Vitamin A deficiency or excess influences embryonic survival. They found nothing in MEDLINE but are still searching other data bases that are more focused on large animal research (I) (013901)

2. Found an entre into a previously refractory research area (9)

Researcher had been interested in insulin-like growth factors and the role they might play on the lining of the uterus (decidua) during pregnancy, but didn’t really know where to go with this idea and hadn’t been able to find anything in the literature. MEDLINE search suggested these binding proteins may be made by the decidua and also gave indications of the experimental conditions under which others had been able to find them. Respondent was able
to formulate a research plan and develop a successful research program. (046802)

An article in a German journal revealing the same interaction between drugs that modulate calcium channels and tinnitus in humans that researcher had seen in his animal model encouraged him to pursue the research (because so little had been done in this area) and to move on to the next stage using calcium channel modulators on his animal model to see the influence of different drugs. (074801)

3. Determined whether a problem of interest had been adequately investigated or resolved (41)

a. Determined area was wide open for new research (15)

Public health researcher found little information in the literature on an association between colonic polyps and either papilloma virus or skin tags (an association which he thought he had observed in his patients), and he was encouraged to look further at cases in own hospital to see if solid evidence of an association could be found (047501)

Absence of controlled studies comparing brachial artery placement with other arterial line placements convinced pediatrician in intensive care unit to set up a research protocol to investigate the issue further. (U13402)

b. Identified a gap in existing knowledge open to new research (26)

While working on biochemical effects of radiation, researcher had obtained preliminary evidence that calcium played a role in induction of cell death by radiation. Information discovered on work by a previously unknown researcher led to articles which confirmed and explicated this
phenomenon. Researcher subsequently modified research plan to build on other researcher's work instead of repeating it. (056803)

While designing a study on preterm infant feeding behavior by bottle, physician found most articles were dated and descriptive of older methods; newer techniques such as pulse oximetry were not mentioned. He decided to replicate data from older studies, confirm their results, and conduct his study after finding the information he needed on pulse oximetry. (U11001)

After obtaining no evidence of research studies that dealt specifically with the relationship between cocaine and myocardial infarct, only case reports, cardiologist decided to design a protocol and conduct a study to determine if there is such a relationship. (T00102)

4. Contacted colleagues to generate ideas (2)

An article with list of books which identified researchers in his field of interest allowed dentist to contact these individuals to obtain more information and names of other people to contact. (078102)

B. Sought research funding or collaboration (37)

1. Enhanced credibility by demonstrating full command of current state of the science in study area (17)

Information from both classic and current articles in research area (e.g., wound healing, immunosuppression) provided a broader context for researcher's own work and helped him prepare a credible background section for grant proposal. (049102)

After reviewing literature on food attitudes and eating disorders in non-Western cultures (which was practically non-existent), respondent had
the information base necessary to establish credibility with Chinese colleagues and set up own survey during trip to China (017902)

2. Justified the significance and/or appropriateness of a proposed research study (11)

Results of large-scale surveys of atherosclerosis in childhood (from the literature) were used in grant proposal by respondent to underscore the significance of researcher’s own proposed survey of pediatricians’ attitudes and behaviors vis-a-vis early prevention of adult cardiovascular disease in their patients. (060501)

In the course of his work, researcher found that compounds that increase the CGMP inside the cell cause the cells to differentiate in the HL-60 cell line. Review of the literature to see if this had already been reported in other cell lines revealed that it had not been and encouraged him to write grant proposal and proceed with research. (045802)

3. Evaluated potential for collaboration with other researchers (6)

Researcher had attended a professional meeting and met 12 investigators from different countries, all working in respondent’s field of molecular cloning and amino acid sequences. Reviews of the published works of each of these individuals helped him determine their value as potential collaborators and generally guided further interactions with them. (013902)

Before meeting with a potential collaborator, pharmacologist obtained a complete list of that neuroscientist’s publications since graduate school, and developed a complete picture of the individual’s interests and other collaborative work on which to base his decision. (074402)
4. Secured review by most appropriate funding agency or agency component (3)

Based on review of published work of study section members, researcher confirmed that agency component to which grant had been submitted had the orientation (carbohydrate analysis rather than molecular biology) necessary for an appropriate review (013802)

Based on review of appropriate literature on control of fatty acid utilization and the different approaches that could be used to study the topic, member of study section determined feasibility of each approach, presented in the grant applications he was reviewing and whether the methodology was precise enough to answer the questions proposed, in an area with which he was somewhat familiar. (074202)

C. Planned and executed the investigation (68)

1. Formulated specific research questions (7)

Information was gathered for a clinical study of the incidence of ruptured aortic aneurysm which included demographic data (age groups in which it occurs, sex, etc.) and associated diseases. This allowed physician to work up a research protocol to study his accumulated experience with this problem over the past five years. (U00502)

Information was obtained on pathogenesis of ultraviolet carcinomas which provided researcher with ideas of possible test models to study treatments to modify ultraviolet-induced cancerous lesions. (P10602)

2. Identified important variables and control conditions (10)

Researcher working in reproductive endocrinology wanted to investigate a group of compounds called lipocortins, focusing on whether these compounds are secreted or produced by the placenta. Information about
the chemistry and molecular biology of these compounds and their biological effect helped researcher conceptualize the experiments and to get suggestions as to appropriate protocols (e.g., doses, exposure times, etc.) (046801)

Physician researcher noted clinical problems among certain patients using experimental total-joint prosthetics made of polyethylene. Used retrospective case study of own population combined with a review of literature on clinical and theoretical studies of these types of prosthetics to isolate precisely what failures might occur and what clinical and other factor were related to these types of failures. Used results to help guide search for better prosthetic joint material (045401)

3. Selected appropriate protocols and techniques (38)
   a. Confirmed safety of proposed research protocol (1)

   Researcher was planning a study of the use of low dose aspirin to prevent fetal growth retardation in patients with abnormal umbilical artery blood flow used information from review of prior research to confirm that the side effects of the proposed protocol would be within acceptable limits for mother and baby (060802)

   b. Identified or developed a protocol, technique, or tool that rendered the research technically feasible (23)

   Renal biologist needed an inhibitor of acyl-CoA synthetase so as to distinguish between the effects of volume regulation and beta oxidation on butyrate. MEDLINE search turned up Japanese investigators who had isolated an appropriate inhibitor and compound was obtained directly from them for use in the researcher's experiments (052401)
Researcher was unable to identify a review article describing the methodology for synthesizing Schiff bases and subsequently had to review Chemical Abstracts by hand to get the information before proceeding with research (I) (046603)

Researcher used information on the properties and sequence of the ovalbumin gene, as well as information on the techniques for isolating and utilizing the gene, to help devise methods for cloning the gene into a plasmid and thence transforming plants to increase their nutritional value (046602)

c. Identified or developed best protocol or technique based on comparison of alternatives (14)

Researcher was not able to obtain information on how photoreleasable compounds are made and what they are used for. Consequently he was unable to decide whether these compounds would be useful in his own research and had to select a different method to try to reach research goals. (I) (T00603)

Researcher obtained several review articles which indicated that the cytobrush was the best method for cervical cancer screening, and researcher could design his protocol to study cervical cancer screening. (034501)

4. Modified planned procedures when warranted (13)

a. Incorporated a method, technique or equipment to solve a central problem in the investigation (3)

Researcher had evidence from enzymatic treatment that there were different kinds of carbohydrates on androgen-binding
proteins, but had been unable to define the specific carbohydrates because the enzymatic procedures that could separate the sugars also denatured the protein and interfered with radioactive tracing. Information from the literature on seriolectin chromatography allowed the researcher to fractionate the glycoproteins and separate the different classes of sugars without denaturing the protein, so that the research proceed (049302)

Researcher obtained the specific physiological procedures for measuring radionucleotide-labelled transfer across the blood-brain barrier, which helped him enter a new area of research which has subsequently expanded to account for a major research area in his laboratory. (P21101)

b. Substituted a method, technique or equipment giving better results than the one in current use (10)

Researcher's prior method of SDS page electrophoresis, using saponin, was destroying the proteins in erythrocyte membranes and frustrating efforts to measure the erythrocytes. Information from a MEDLINE search turned up two new alternate methods, and researcher switched to one which uses the SDS itself to lyse the cells. The research was then able to proceed (058301)

Information on methods using DNA probes to localize chromosomes within the nucleus of the lymphocyte cell allowed researcher to enhance his own techniques in various ways, e.g., by adopting a different solution for removing nonspecific staining from slides (044502)
D. Executed secondary or meta-analysis of published data or research (13)

1. Performed meta-analysis to evaluate adequacy of existing research (11)

   Researcher analyzed sample sizes of published negative clinical trials of treatments for cystic fibrosis during the past 10 years, concluded that most did not have the statistical power to confirm null findings, and wrote paper advocating more multicenter trials to increase power (033401)

   In context of a research paper for M.P.H. program, emergency medicine physician analyzed published data on trauma mortality before and after the introduction of specialized trauma centers and concluded that these centers had done little to influence overall mortality rates (028401)

2. Analyzed attitudes and opinions as evidenced in published papers (1)

   Doctoral student writing a dissertation on the rise in biophysical, high-technology medicine in the 20th century, particularly the artificial heart. Review of medical literature allowed him to incorporate attitudes of clinicians as well as non-physician commentators and to demonstrate that conflict over the ethical quality and overall efficacy of these devices exists within medicine as well as elsewhere. (048901)

E. Interpreted and reported results (57)

1. Developed an interpretation of research findings (16)

   a. Identified a mechanism that would explain unusual or puzzling results (6)

      Information on the base levels of glutathione peroxidase in leukocytes allowed physician researcher to explain why there was an unexpected increase in
glutathione peroxidase in the lungs when they were experimentally implanted after being treated with a preservative fluid to keep them viable longer. Since it was too soon for enzyme induction to occur, the rise had to be due to an influx of cells into the lung. (044402)

Physician/biochemist unearthed a little known paper that described an alternate reaction of guanine methyl sulfate that blocks in vitro DNA synthesis by undergoing further degradation, and thus explained the unusual result their lab obtained where dimethyl sulfate interacted with guanine residues to cause inactivation of reverse transcriptase. (065501)

b. Identified a model or theory that fit experimental findings (4)

Information on the rolling circle model for plasmid replication allowed the researcher to explain how his PE194 plasmid replicates and makes bacteria resistant to erythromycin, and provided some new directions for his research to take without repeating other experiments which the researcher believed were done incorrectly. (056603)

Information on a model of peptide metabolism and elimination, was used by a pharmacologist to interpret data that had been gathered from rats and monkeys on the peptide in question, in his role as consultant to a pharmaceutical firm that is planning to use the peptide as a drug. (019001)

c. Developed or refined theory so that it would encompass new findings (3)

Information from the literature on the role of specific catalases in oxidative reactions involved in the process of
differentiation, in conjunction with researcher's own findings, allowed the researcher to publish a paper advancing the theory of the role of oxidative reactions in development. (028702)

Information that the zinc-binding protein that the biochemist was studying did not fit with the zinc fingers model of binding caused him to alter his model for zinc binding of the protein and try to come up with an alternative model. (073103)

d. Analyzed methodology in order to interpret research findings (3)

Scientist found a relevant and well done study in the literature which helped him extend his knowledge of drug movement through the body to model the movement of antibodies (a much larger molecule). He then used this information to interpret data from a study of two antibodies against breast cancer, and particularly to derive pharmacokinetic parameters from data on antibody blood levels as a function of time after administration. (019002)

Information obtained by research psychiatrist on other studies utilizing non-psychosocial factors that can affect immune system function was used to interpret his own research findings on how long it takes HIV-positive individuals to develop full-blown AIDS, and also to integrate this information into the study in order to control for these non-psychosocial factors. (T07401)
2. Determined the significance of research findings (13)

a. Determined that findings had not been previously reported and should be published (5)

Lack of information on the effects of beta agonists on cytosolic calcium and and cyclic AMP and their influence on glycolysis in the heart, convinced the cardiologist researcher that his specific study had not been performed previously and that the article he was writing presented some new ideas about the efficiency of heart function when glucose is being utilized. (T02501)

Failure to obtain information on angiogenesis in tissue culture made the researcher question whether he should write up the results of the system he developed using endothelial cells in tissue culture as a model for the growth of endothelial cells on vessel prostheses in surgery, because he didn’t know if the system had been reported before, and resulted in a delay in publication. (I) (021901)

b. Determined that findings contradicted prevailing opinion and should be reported (3)

Information on the successful use of Verapamil, a calcium channel blocker, to treat patients with tardive dyskinesia conflicted with the negative results obtained by an osteopath researcher who had conducted a single blind-ABA design study and convinced him to write up his results as a negative study. (U12503)

Published information indicating a better outcome with donor blood transfusions prior to transplant compared to treatment with cyclosporine reinforced nephrologist/immunologist researcher’s
decision to publish his conflicting
experimental results which indicated a
better outcome with cyclosporine than
with blood transfusion. (T07802)

c. Determined that findings were worthy of
further investigation (5)

Information that showed a direct action
of insulin-like growth factors on growth
hormone in the pituitary of the rat, plus
articles by the same author on gene and
protein regulation, supported validity of
researcher's decision to continue
exploration of role of IGFs in regulating
growth hormone rather than the
converse. (033501)

While no information was found on
increased rates of suicide among new
settlers, information on increased suicide
rates among immigrants, and the
symptoms of early risk (boredom,
alcoholism, and argumentative behavior)
convinced researcher to propose a
follow-up study on the high rates of
suicide among settlers in the wet zone of
[country] focusing on the symptoms of
early risk. (U08802)

3. Prepared report of research (28)

a. Cited corroborating evidence from other studies
in report of research findings (11)

Information from an English journal
revealing that Russian researchers had
obtained chemical evidence of
attachments for carbohydrates on
steroid binding sites supported
researcher's findings from enzymatic
studies and produced a more
authoritative discussion of his data in a
research paper (049301)

Lack of information on the length of
time it takes neutrophil cells to move

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from inside to outside of blood vessels, did not provide the pulmonary diseases researcher with desired evidence needed to corroborate his findings on the change in the adherence of neutrophils in the respiratory tract as they move from inside to outside of blood vessels during airway inflammation. (I) (061303)

b. **Provided relevant context of other research in which to discuss methods and results in research report (10)**

Information in two previously unknown articles on changes in renal function with aging and the relationship between renal and cardiac function was incorporated into paper reporting on researcher's own study of how renal changes predict changes in cardiac function (T00602)

Information describing other examples of proteins with O-linked glycosylation allowed the researcher to tell a more complete story in the introduction to a paper on the glycosylation of the peptide fiber protein, which is an adenovirus of the cell receptor, involved in the initial process of infection. (073102)

c. **Avoided omission of other relevant research in report of research (7)**

Identification of all the review articles on the prognosis and treatment of polymyositis in the past three years gave physician researcher a basis for comparison with his own concepts and findings in paper on his research (045702)

Information on the isolation of the blastomycosis fungus from a beaver dam or fishing hut, which is difficult to isolate in the laboratory, allowed the veterinary researcher to include all the relevant research in his paper on the evaluation
III. Teaching (254)

A. Provided instruction in the basic sciences (6)

1. More effectively prepared lecture for undergraduate college science course (1)

Information was gathered for a lecture to university undergraduates on the Drosophila homeobox (a DNA sequence in some mutants), and the citations themselves were presented to the class as handouts. (050701)

2. More effectively prepared lecture for graduate student seminar (2)

Information obtained on axonal transport including recent developments in the area of moving biochemicals along the axon, gave the researcher the most current information to prepare a lecture for graduate students. (058602)

Information obtained on the broad areas of colony stimulating factors and the subclasses, gave the researcher, who was not versed in the area, sufficient information and key review articles to use in presenting the seminar to graduate students. (013903)

3. Provided students with bibliography to prepare paper (3)

Information obtained within 30 minutes on tuberculous meningitis enabled a 3rd year medical student to begin to write classroom paper on the topic. (060403)

References were assembled, on cardiac assist devices in animals, by a faculty member, which graduate student could use to develop a bibliography of other people’s results to compare with her own. (P10805)
B. Provided clinical instruction (73)

1. Supplemented own or resident's clinical teaching on the wards (7)

Information was obtained to teach medical students who were treating asthma patients, about asthma giving them general information on the condition, new drug therapies and under what conditions these drugs were recommended. The information also provided the physician with reassurance that his new use of steroids as a first-line medication was correct. (T04201)

Information obtained on multiple myeloma—the history of the disease and previous therapies—was used by the physician to augment a resident's talk in rounds about a particular patient, thus underscoring the evolution of treatment of the condition. (P12404)

2. Prepared educational resource for use by students, residents, or faculty (12)

a. Provided students/residents with selected references or a reference list (4)

An article obtained via MEDLINE that catalogued all the malpositions which can occur with catheter placements was given to residents by physician to aid them in reading the malpositions on films and to serve as a reference when they go into practice. (029102)

Articles obtained on the ethical issues behind the Harvard criterion for brain death was used by a faculty member in as a basis of discussion with his residents preparing for a section of the MKSAP-7 board examination. (038803)
b. Provided students/residents with special-purpose literature data base (1)

A database was developed consisting of all articles appearing in the past several years in the most commonly used journals in the anesthesia department library, which made searching very easy for the residents and served as their first-line reference tool. (P10806)

c. Prepared or assembled bibliography to supplement a presentation (7)

A list of citations to articles on the use of computers in medical education, sorted by type of use, was distributed as a reference to supplement family physician's talk on his own uses of computers with information on what others are doing. (041803)

Physician researcher obtained all items in the bibliography of a visiting researcher and was able to print it out directly, in the correct (inverse chronological) order, and distribute it in advance of the researcher's lecture. (052601)

3. Prepared clinical lecture or graduate symposium (13)

a. Developed content of talk (11)

New information suggesting that the various psychological problems experienced by women during menopause are not necessarily related to any physiological process corroborated what nurse already knew and gave a different perspective on that aspect of women's health care that she could use in a lecture to nurse practitioners on the menopause. (T04002)

Rapid and inexpensive acquisition of a series of articles giving information on

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the success rates in treating optic nerve trauma by surgical or medical means greatly facilitated neuroophthalmologist's preparation of a lecture on this subject to colleagues. (031201)

b. Assembled audiovisual materials (2)

General information published in the last three years on keratinization of hair follicle epidermis aided dermatologist in preparing a talk on this subject and provided pictures to use in the talk. (016401)

An article on the arterialization of the dorsal vein of the penis provided urologist with the figure he needed to reproduce as a slide as part of his lecture presentation. (063501)

4. Prepared for case/clinical conference (8)

a. Augmented own information on case and management (7)

Information in a review article giving the newest information on antibodies which might be specific to drug-induced lupus was obtained and used to supplement a case conference on a patient with this condition. (052602)

Failure to find information on what cancer cells have receptors on their surface for colony stimulating factors meant that hematologist/oncologist could only conjecture that this might be happening in the patient he was presenting at case conference whose lung cancer was producing a factor that stimulated the production of eosinophils. (I) (070502)
b. Provided input on specific issues related to case (1)

Information obtained on the treatments used for cardiac rejection by different transplant centers helped physician present a clinical conference on a patient in rejection, to educate the surgeons and the cardiologists as to the therapeutic options and stepwise approach to care, and when they should think about using various anti-rejection agents such as azathioprine, cyclosporine and antilymphocytic globulin. (T07501)

5. Prepared broad review for major professional presentation (28)

a. Incorporated additional information in presentation at grand rounds (13)

Failure to obtain information on clinical research on peroxisomal disorder meant that physician had to re-search the human literature in order to prepare an adequate review for a grand round presentation on a patient with this condition. (I) (036401)

Identification of a broad review on the subject of the renal manifestations of multiple myeloma provided physician with sufficient information to address the common and uncommon manifestations of renal diseases in multiple myeloma in a grand rounds presentation. (T02302)

b. Incorporated additional information in presentation at teaching conference (7)

Information indicating that antibiotics were indicated for animal bites on the hands and feet, but that for all other bites irrigation and debridement were more important allowed physician to include this information in a teaching
conference on animal bites for medical students and residents (032501)

New information on the use of aerosol bronchodilators in the management of asthma in children was included by pediatrician in a teaching conference he conducted. He also changed the management of his own patients, selecting an agent specific for bronchodilation rather than an agent he was taught to use as a intern, which had side effects such as increased heart rate. (T01801)

c. Incorporated additional information in presentation at professional meeting (8)

Comprehensive information on contact lens complications enabled ophthalmologist to identify the specific problems that lead to corneal ulcers and hence to focus his talk (being given to a large group of practicing ophthalmologists) on the most important issues in preventing this problem -- aggressive treatment with injections, rather than just treatment with drugs and loose follow-up. (030102)

Lack of useful new information on adolescent behavior and homosexuality, prevented physician from presenting as complete an address as he would have liked on the whole range of risk-taking in adolescents. (I) (021202)

6. Supplemented discussion of article in journal club (5)

Information on diagnosing vasculitis provided the physician researcher with a complete bibliography from which he could review the state of knowledge than he would have had using the more limited paper he was reviewing for presentation in a journal club. (052603)
Information obtained for a journal club presentation on the use of leading edge cultures on lesions such as cellulitis suggested a larger number of positive cultures than the physician was used to seeing in his hospital. Physician added article to his reprint file and decided he would perform the procedure in the appropriate patients since it would give more information.  
(T04701)

C. **Provided inservice/continuing education to clinical personnel (36)**

1. **Provided education on diagnostic techniques (9)**

   Information obtained in order to educate physicians in the clinic on the indications for use of Doppler ultrasound helped guide the physician in describing the most current indications for the use of the technique.  
(038301)

   Information obtained on the indications for carotid vascular ultrasound testing and the indications for referral allowed physician to present a class to other physicians and technologists because he was able to be certain that his information was clinically validated and that he was disseminating the most current body of knowledge on the topic. (T06501)

2. **Provided education on therapies (15)**

   Specific data comparing the effectiveness of streptokinase and TPA, and supporting the point that TPA is more effective, were useful in preparing talks to be given by physician to small satellite hospitals who were concerned about the high cost of TPA.  
(P20201)

   Specific information on the effects of various stimuli (light and sound) and the effects of longer periods of quiet time on growth rates, allowed nurse to prepare a program for other neonatal intensive care nurses on the effects of the environment on the newborns, making the nurses more sensitive to the developmental, as
well as physical, needs of the newborns.
(U09102)

3. **Provided education on a disease entity (4)**

Information on the relationship between papillomavirus and malignancy, including the increase in the number of strains coinciding with the increase in cervical change and premalignant lesions, as well as the information that laser surgery will remove the lesions but not get rid of the virus, convinced physician to inform his medical group that the viral infection is not curable, that males need to be treated as well, and that the whole field of OB-GYN needs to be alert to the problem. (062901)

Primary research articles on the etiologies, diagnostic approach, and treatments for chronic cough in children, including reactive airway, was used by the physician to prepare talk on this subject to residents and doctors in the community. (067901)

4. **Provided education on a professional activity (8)**

Absence of relevant general information on how to do nursing research and how to evaluate research in journals, appropriate for people who are not knowledgeable about the process, convinced the nurse not to give the nursing inservice she had planned. (I) (U11003)

Broad information on the ethical problems related to code arrest situations, including the feelings of professionals trying to resuscitate patients who did not want heroic measures taken, allowed the nurse to include some of the opinions and research surrounding this issue in her presentation to the code arrest team. (U11101)
D. Provided education for inservice/continuing education to community health care or public health personnel (3)

Information was obtained on the use of smokeless tobacco in adults and children, and the health implications of its use, which convinced physician to develop and present a program on the epidemiology and the implications of its use. (043001)

Information on the common types of vaginitis in reproductive-aged women, and various treatments for the condition, allowed nurse to assemble the most current information for her lecture to public health nurses. (T04001)

E. Provided educational services to the community and lay public (15)

1. Developed and presented health education lecture/course for lay community (7)

Information was gathered on child safety (mode of presentation at various ages, need for parent knowledge assessment, and useful illustrations) which the nurse used to refine the safety programs she presents to the community. (010502)

Information on the value of humor, anecdotes, and use of humor by nurses, as well as the names of critical workers in the field, allowed hematologist to familiarize himself with the entire field in a few days in order to prepare a seminar for the public on the emotional aspects of cancer and laughter and medicine. (U19403)

2. Provided information/advice to address inquiry from lay public (6)

Physician received a request from the national headquarters of a youth organization for information on the proper treatment of fire ant bites to include in their manual. After reviewing the literature the physician was able to tell them that there is no specific treatment to counteract the formic acid, and that these
bites can only be treated symptomatically. (T05802)

Non-physician writing book for older consumers on prescription drugs was able to incorporate hard evidence on the increased incidence of falls due to dizziness in older people taking benzodiazepines to support his thesis that there was a correlation between the two, a thesis which previously had been based only on his own common sense. (055301)

3. Provided technical information to pharmaceutical salespeople (2)

Information obtained from the literature on the dosage range for treating arthritis, onset of effect, the overall safety and the lack of risk of neoplasia due to the use of one of his company's products provided pharmaceutical salesperson with the basis for a presentation at a sales meeting and made a favorable impression on his supervisor, since an article he found had been circulated by the company several years before but had been forgotten. (054101)

F. Initiated an article or case report (33)

1. Determined that own clinical observations or approach was sufficiently novel or important to be worth contributing to the literature (20)

Physician who had patient with mucoepidermoid carcinoma of the lacrimal gland determined that the number of previous case reports was small enough that it was worth reporting on the results of the biopsy and treatment (surgical removal) of this potentially life-threatening lesion in this patient, for the benefit of other pathologists and ophthalmologists. (052702)

Information about current therapies for pheochromocytomas will contribute to physician's decision on whether or not to prepare a journal article based on several such
cases seen in his practice, since he found that there is little consensus on whether to operate for this condition during pregnancy but that others have addressed many of the concerns involved. (T02102)

2. **Supplemented report on own clinical experience with supporting information from others’ experience or research findings (13)**

   Information from case reports, literature reviews and articles on metabolic effects enabled trauma surgeon to incorporate a more complete information base in book chapter he was preparing on lead intoxication from retained missiles (such as bullets), rather than only information on the patients he had personally treated. (T03001)

   Information from case reports and review articles enabled physician doing 12-year follow-up of unconventional (radiotherapy) treatment of a patient with ameloblastoma to incorporate what had been done with this technique in the ensuing time period. (032702)

G. **Prepared a current and authoritative review of a topic in the form of an article, book, or book chapter (86)**

1. **Easily and efficiently assembled information necessary to preparation of a published review (10)**

   Information on how to evaluate risks of dental surgery in patients with particular diagnoses and on whether or not to do surgery decreased the time involved in dentist’s preparation of a paper on surgical risk assessment in the elderly. (013401)

   Nurse preparing revisions of certain chapters in her clinical textbooks was able to rapidly confirm and update her information on how acute myocardial infarction, pulmonary embolism, acute renal failure, and the nursing process are related to behavioral modification, relaxation, or imagery techniques. (T08101)
2. Organized manuscript effectively (5)

Analysis of relevant recent literature provided pediatric cardiologist with a basis for organizing a book chapter on the use of echocardiography for description of ventricular inflow anomalies, and also provided previously unknown information on the high incidence of mitral valve prolapse in the "healthy" population. (028301)

Information on some cytochemistry staining techniques used for the diagnosis of acute leukemia, which were new to him, as well as complete citations for references used as background, allowed physician to efficiently organize the material for his book. ((063302)

3. Incorporated most recently published information on topic (18)

Information obtained on the epidemiology of senile dementia from author he believed had been to be writing on this topic enabled epidemiologist to incorporate this most recent information into an introductory book on the epidemiology of mental disorders. (042301)

Information on the current surgical approach to trauma of the genitourinary system was critical in enabling radiologist to prepare a chapter for a book on the radiology of trauma that would provide an emergency room doctor with accurate information on x-ray approaches most helpful in treating such an injury. (T03201)

4. Incorporated information that insured that review was comprehensive (28)

a. Incorporated complete set of references on topic (20)

Failure to obtain relevant and useful articles on the history of the concept of drug addiction, including the failure to retrieve article of which the pharmacist was already aware, meant that his
attempt to write a history of the concept, to parallel an existing history on the concept of alcohol addiction, had to be temporarily suspended. (I) (055303)

Failure to obtain key references on the metabolism of bile acids, except for ones of which the biochemist was already aware, meant that he could not prepare a book chapter on this topic and a paper on a particular bile acid and metabolic product without having a search run on an automated retrieval system with a forward-searching capability. (I) (057501)

Recent information on the epidemiology and treatment of Crohn’s disease, ulcerative colitis, and inflammatory bowel disease in articles previously unknown to physician enabled the preparation of a more complete chapter of a textbook on inflammatory bowel disease. (056901)

b. Incorporated most authoritative information on topic (8)

Lack of authoritative information describing the mechanism behind bleeding (coagulation) disorders after head injury resulted in the nurse only including studies in her nursing journal review article describing types of patients, severity of injuries, and likely abnormal lab studies seen with patients exhibiting this complication. (I) (U05903)

Relevant articles describing both clinical and basic research studies, which provided evidence of sympathetic nervous system involvement in arthritis, allowed neurophysiologist to write a more authoritative section on this topic in a book chapter and to propose specific mechanisms of involvement. (025403)

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5. Incorporated specific information that s/he had not previously known into review (17)

Information from articles discussing different drugs that are toxic to the kidney, including information of which he was previously unaware indicating that indomethacin can cause kidney damage to the fetus, was incorporated by pediatric nephrologist in review article on such toxic drugs. (058502)

Pediatrician writing chapter for a book on viral infections in children was able to incorporate new information from articles in a journal of whose existence s/he was previously unaware. (028901)

6. Incorporated current, accurate information on topic that was somewhat outside own area of expertise (5)

Failure to obtain information on the pharmacologic effects of drugs on gastric emptying in infants and children delayed pediatric anesthesiologist in writing chapter on the anesthesia management of GI surgery and caused concern that he was missing something important related to gastric physiology, which is outside his own specialty. (I) (031001)

Clear information on the population of women who should be targeted for grief counselling after giving birth by caesarian section and the impact of breast feeding success or failure on these women, allowed nutritionist to prepare an article on the topic, which was outside of her field of expertise. (U14502)

7. (Unable to determine appropriate title to be given to book in preparation) (I)

Failure to obtain any titles of existing books on food allergy via MEDLINE to help settle a disagreement between the author (an allergist/immunologist), the book sponsor, and the publisher on what the title of the author’s book should be led the physician to ask the
medical librarian to run the search, which she did, on CATLINE, and obtained many articles. (I) (070601)

3. Responded to reviewer’s comments on review article (2)

Information suggesting that DTPA (a first cousin of gadolinium EDTA) was more toxic than other less stable compounds as a contrast agent in NMR imaging reinforced the feelings of physical chemist that there is not a simplistic quantitative correlation between stability and toxicity, as the reviewer of his paper thought, and he was able to refute the reviewer’s comments with factual information. (057801)

Information which indicated that the only basic research articles written on the topic of the interaction between glutathione and copper to generate hydrogen peroxide and oxygen radicals were theoretical discussions, rather than the biochemist’s experimental study, and he was able to refute the reviewer’s comment that his work was confirmatory. (073401)

H. Carried out bibliographic analysis—determined trends in numbers and types of publications on particular topic (2)

Identification and topical analysis of 400-500 papers on the subject of ritodrine tocolysis (drug therapy for inhibiting premature labor) enabled physician to document the number of papers published per year on this topic and on several specific aspects of the topic for a paper on the national impact of ritodrine therapy. (T05501)

Citations for 400 pertinent articles in the area of the history of ethical dilemmas concerning neonatal infants published between 1966 and 1986 were used by a nurse pursuing a Ph.D. to develop a chart showing the number of references in each time period and in different subject areas for review by her dissertation committee. (048401)
IV. Learning (77)

A. Furthered own formal education (16)

1. Prepared paper or other report for graduate coursework (10)

   Recent information on brain injuries due to trauma, including less central information on facial injuries, added to health sciences graduate student’s knowledge of this field and enabled the preparation of a more current book chapter on the rehabilitation of patients with such injuries. (T01601)

   Information consisting of expert views and description of current systems provided the basis upon which graduate student in health services carried out a project to design the specifications for a clinical-financial decision support system to be used in the health care industry for a class project on which he received an "A" grade. (T01502)

2. Characterized research areas of individual or laboratory being considered as location for fellowship (6)

   Out of curiosity about an area that was not covered even three years ago when he was in medical school, physician carried out a search on tumor necrosis factor and how it applies to clinical disease. The large number of articles obtained reinforced his decision to do a fellowship in a laboratory that he found was doing research in that area and has also affected his long term career plans. (T03303)

   Information indicating that a researcher on neuronal development had previously used biochemical methods in his work led biochemistry graduate student, who wanted to use the methods with which he was familiar to study neuronal development, to apply (successfully) for fellowship to be done in the researcher’s lab. (051002)
B. Furthered own informal, continuing education (31)

1. Kept up to date in own primary area(s) of expertise (19)

Pathologist working in area of child abuse and routinely reviewing recent publications in related areas found information validating own published assertions that there is no scientific basis for the conclusion that serious brain injury can be caused by shaking, thus providing a more solid basis for his further writing, lectures, and court testimony. (T04301)

Failure to obtain pertinent information on surgery of the GI tract discouraged pediatric anesthesiologist from trying to keep up with such information in the non-anesthesia as well as the anesthesia literature. (I) (031002)

2. Evaluated or demonstrated potential of Grateful Med to search literature (12)

Review articles on an unusual blood coagulation problem due to protein C deficiency provided the faculty member with an opportunity to demonstrate to the resident the use of Grateful Med to access information on an unusual clinical problem. (070001)

Failure to retrieve any articles when he thought there should be a large number of them discouraged physician from pursuing use of Grateful Med because he didn’t feel he had time to sit down for a whole weekend and read the book to see what he was doing wrong. (I) (030701)

C. Satisfied own curiosity/personal interest in a particular topic or phenomenon (30)

1. Learned about some clinical problem of current interest (13)

Physician who was getting behind in reviewing Current Contents obtained all of the
information he wanted on Forcious Erikson ocularomnis. (036403)

Physician interested in Alzheimer's disease determined that there was not much in the literature regarding nootropic drugs - drugs that might enhance the ability to think. (T05102)

2. Obtained more complete information on a brief item encountered in print or via casual comment or question (13)

Information published over a 15 year period on the effects of zinc on the retina, including information on retinal degeneration and retinal atrophy, was given to ophthalmologist who asked physician a question about this in passing. (033303)

Information was obtained to answer a question posed by a pharmacy student's preceptor on the role of neuroregulator (serotonin and norepinephrine) levels in Alzheimer's disease patients by using the information from abstracts on levels of the two neuroregulators in the brain tissue of these patients. (059702)

3. Learned about treatment for a personal medical problem (1)

New references on the treatment of stomatitis, which outlined new therapies to try, where previously there had been none, gave physician some new information on his own medical condition. (P11501)

4. Updated own curriculum vitae (3)

Retrieval of citations to all of his own publications, allowed pathologist to prepare a complete, updated CV for promotional purposes. (68603)
V. Administration (70)

A. Formulated a strategic planning process (2)

Hospital had undertaken a strategic planning effort, and individual responsible for pharmacy planning wanted to know more about how to apply systems analysis and strategic planning techniques. Review of articles on strategic planning for nursing and allied health services led to specific ideas on how to conduct the internal analysis and how to work productively with various groups in the planning process (044002)

Information on the etiology of urinary tract infections was used by a urologist to develop a plan for tracing the source of urinary tract infections in these patients and to develop a tracking system for monitoring the infections. (066602)

B. Addressed personnel matters (8)

1. Evaluated qualifications of potential employees or consultants (5)

Individual responsible for interviewing an applicant for an attending physician position used information on the candidate's published work to explicate the individual's interests and areas of concentration. This information was then used to help structure the interview process. (049401)

Administrator had to hire outside reviewers to assist with promotion and tenure process for faculty members. Published work by potential reviewers to was used to identify their specific areas of expertise and determine the most appropriate reviewers for particular faculty members. (048502)

2. Resolved personnel safety issues (1)

Information indicating that an individual with a chronic health problem (hyperthyroidism) was still at risk for medication side effects, even after a prolonged period on the drug, led agency physician to refuse to grant the
individual a waiver to travel on an ocean-going vessel operated by the agency. (031102)

3. Determined personnel needs and utilization (2)

Physician on Quality Assurance committee obtained information on the use of nurses to triage X-rays and laboratory work in the emergency room, in other hospitals, which he used to help his committee determine where the hospital's policy stood from a national perspective and helped support his recommendation that the hospital implement these changes. (P11302)

Physician-administrator responsible for health-related school programs wanted hard data on the cost-effectiveness of school nurses to bolster arguments against cut-backs in this category of personnel. Was unable to locate articles with such hard data and school district is consequently still struggling with the problem of how to evaluate the need for school nurses. (I) (T00203)

C. Established standards, policies, and procedures (44)

1. Determined most appropriate therapeutic agent or procedure (30)

a. Determined which agent or procedure was more effective (19)

Physician was on clinic committee responsible for establishing guidelines for treatment of uterine fibroids. Failure to turn up any large or long-term clinical trials of the use of LHRH analogs for this condition led physician to recommend that this treatment not be included in the guidelines. (019402)

Pharmacist on a committee evaluating whether to add TPA to hospital's formulary concluded, from information obtained, that TPA is a good thrombolytic agent and should be added,
but that it should not be used with elderly patients or patients with previous history of stroke because of an increased risk of cerebral hemorrhage. (U17501)

b. Determined which agent or procedure was safer (6)

Physician team investigating birthweight mortality statistics at own institution realized that local mortality rates for given fetal weights were higher than national rates reported in the literature and they are in the process of revising pregnancy management guidelines accordingly. (011203)

Physician in an HMO was preparing protocols for home care for children with acute infectious diseases. Based on information obtained, he concluded that it was safe to transfer children home who have been afebrile for 48 hours and included this criterion in his protocol. Without the information, he would not have gotten as good agreement on this aspect of the protocol from his colleagues. (051801)

c. Determined which agent or procedure was more cost-effective (5)

Information obtained from reputable journals that triamcinolone inhaler was superior to betamethasone inhaler based upon solid, double-blind studies gave pharmacy and therapeutics committee a clear answer as to which was better, and saved money by removing betamethasone from the formulary, since triamcinolone cost considerably less. (U06602)

Absence of information suggesting any inotropic (increased heart activity) effects in humans of a particular beta adrenergic agonist used in treatment of
COPD and asthma, only in animals, supported the data from the manufacturer and led pharmacist to recommend to Pharmacy and Therapeutics committee that it replace its current beta adrenergic agonist with the less expensive one because it is at least as effective. (U03201)

2. Developed quality control measures (9)

Information on the transmission of Clostridium difficile infections in the hospital setting through improper handwashing and portable commodes enabled quality control supervisor to educate staff and get their cooperation in instituting more stringent cleanliness measures and controls with compromised patients in the rehabilitation unit, where they had encountered a number of cases of this infection. (U11302)

An article with diagrammatic instructions for urine collection provided a clinical microbiologist with the information necessary to develop such instructions for patients with urinary tract infections which will form the basis of a quality control study of urine contamination aimed at improving patient management and therapy. (U18201)

3. Developed precautions to avoid exposure by staff to possibly harmful agents (5)

Absence of information from any validated study that there can be aerosol transmission of methicillin-resistant Staphylococcus aureus (there was only one undocumented report) allowed nurse administrator to allay fears of the staff that the organism is transmitted through the air, but to emphasize through an inservice program that it is transmitted by poor handwashing and by being splashed with contaminated fluids. Universal precautions on contact with fluids were also instituted. (U18501)
Absence of clear information on human teratogenic effects of Ribavirin, an aerosol antiviral agent, only of animal teratogenicity, and suggestions that health care workers should use barrier precautions (mask, gown and gloves) when administering the drug, allowed the pharmacist to respond to a question of a physician who had been given contradictory information by a colleague. (U18502)

D. Developed basis for establishment of a new facility or service (12)

Information on children's hospitals that were based upon different financial models and on a system of patient service reimbursement that was economically sound was useful to hospital administrator in finalizing an approach and developing the financial justification for opening a new children's hospital. (U09502)

Lack of recent information on group therapy in adolescent girls, including selection and therapy techniques, resulted in social worker relying on information she had from conducting such a group many years before in developing a new group for adolescent girls who were withdrawn, depressed and had low self-esteem. (I) (U10801)

E. Evaluated efficacy of a governmental program (1)

County health department employee thought proposed new state regulations that would require all medical wastes to be treated as hazardous wastes were unnecessary and would place an excessive burden on local hospitals. A review of the literature revealed no objective evidence of spread of disease from solid hospital wastes and, on this basis, the employee recommended modifications in the proposed regulations. (T04801)

F. Performed editorial duties for a journal (1)

Accurate citations for the relevant journal articles allowed the editor of a veterinary journal to spot-check references in manuscripts, tell the authors the mistakes that were found and needed to be fixed, and
resulted in more accurate articles in his journal than in other journals. (01071501)

G. Made determinations on investigational drug application (3)

Information on white blood cell labeling with a particular substance, including the procedure, its minimal side effects, and instances of false positive and negative reports, allowed physician to assemble the information to submit an application to the FDA so that a group of patients could be tested with this new nuclear medicine technique for assessing a suspected abscess. (01062802)

A description of a number of patients who had received a particular chemotherapy agent intrapleurally, with apparent safety, convinced agency representative to approve request of an investigator for an exemption to initiate a study to evaluate the use of this drug for breast cancer, when it had only been approved for leukemia. (044901)

VI. Consultation (35)

A. Provided medico-legal consultation (32)

1. Determined probable etiology of a contested injury/condition (15)

Patient who had sustained a skull injury in an industrial accident several years earlier showed progressive neurological deterioration and eventually died. Rural physician who had treated this patient for several years used information from the literature to support Workman's Compensation claim vis-a-vis probable cause of death (010802)

Medical chemist consulting to a law firm representing a drug company used information from the literature to advise that aseptic femoral necrosis was a rare, but clearly documented, side effect of corticosteroids (as the patient-plaintiff had claimed). (048503)
2. Determined whether prognosis for particular condition was affected by an incorrect or delayed diagnosis (4)

Neurologist consulting on legal cases involving misdiagnosis of aneurysms needed information on outcome and survival under conditions of early or late diagnosis. Based on the literature, respondent was able to assure plaintiffs' lawyer that delayed diagnosis did negatively affect the chances for a satisfactory outcome even though early diagnosis does not assure such an outcome. (021102)

Neurologist consulting on a legal case involving misdiagnosis of meningitis due to cryptococcus infection needed information on whether prompt treatment decreased the likelihood of brain damage. Based on the literature, respondent was able to assure plaintiff's lawyer that incidence of brain damage was low (5-10%) when appropriate treatment with amphotericin B was started early. (021101)

3. Determined appropriateness of care given (13)

Dermatologist consulting on alleged malpractice in treatment of basal cell carcinoma needed information on established standard of care as of the date of the contested event (1977), which predated the dermatologist's own training. Information from the literature enabled the dermatologist to determine that the treatment given (cryosurgery) was considered appropriate at that time. (019602)

Anesthesiologist was preparing to give expert testimony in defense of the care given by a fellow anesthesiologist whose patient had died after caesarian delivery. The patient had been suffering from severe toxemia and the respondent wanted to strengthen his upcoming testimony with evidence that a pulmonary embolism (one of the suspected causes of death) was a common and potentially serious complication in toxemic patients. (040501)
B. Provided medical consultation to governmental agency (3)

Information on individual DRGs -- how they impact on hospital remuneration and possibly impact care in various services -- allowed physician to present complete and well-documented testimony on the quality of care in the Peer Review Organization program, which contracts with HCFA to review Medicare. (063001)

Information on high rates of tuberculosis among prisons in all states, and confirmation that his rate was similar to that in other states, allowed family practitioner serving as state director of TB control to focus on the general problem of TB in prisons, rather than focusing on this state’s particular situation. (045303)
APPENDIX H

IMPACT OF THE INFORMATION OBTAINED FROM MEDLINE ON THE OUTCOMES OF PROFESSIONAL ACTIVITIES
I. Patient End Results (455)*

A. Longevity (25)

1. Life of patient(s) saved (8)

Case reports of a rare and usually fatal fungal infection and suggested treatment were used by physician to choose treatment (IV miconazole) for a patient with a brain abscess due to this fungal infection. Patient has survived for two years, but would have received the wrong treatment and almost certainly would have died if this treatment had not been located. (035002)

Immediate information describing anaphylactic and cardiogenic shock, and the recommendation that treatment focus on the anaphylaxis as opposed to the cardiac problems, provided physician with a treatment plan for a patient who had taken a certain homeopathic remedy for poison ivy who was in extreme shock and difficult to resuscitate. Patient survived, contrary to physician's expectations, and is doing fine. (039602)

2. Length of life increased (17)

Information describing prognoses, treatments, and medical centers performing treatments for advanced metastatic ovarian cancer was provided by researcher to a physician with a friend with this condition who had been treated with surgery and radiation. Physician located a center performing treatment and patient participated in a clinical trial; patient is still alive. (048902)

*Number in parentheses are the numbers of incidents classified in each category
Information indicating that lymphoblastic lymphoma, which is a rare cancer which acts more like a leukemia than a lymphoma, should be treated aggressively provided physician with information so that patient was treated with round of CHOP followed by a round of another chemotherapy which will increase the 5-year survival rate to 40-50% instead of 5-10% with less aggressive chemotherapy regimens. (040201)

B. Abnormalities (107)

1. Abnormality or disease prevented (10)

Information indicating that a giant cell tumor of the foot required amputation only if biopsy showed malignant changes in the tumors, that metastasis is unlikely, and that biopsy and osteotomy (removal of tumor and bone) instead of amputation are recommended, was responsible for physician performing a biopsy and osteotomy on a patient with a history of this condition and previous tumor removal. The biopsy was negative, the patient's foot was saved, and she is doing well. (T00801)

Information indicating that DIC (disseminated intravascular coagulation) after orthopedic surgery can be prevented by performing prothrombin (PT) and partial prothrombin-plastin (PTT) time tests every two days starting before, during, and after surgery prevented a patient from having more serious postoperative complications because the probability of DIC was detected sooner and morbidity prevented. (T00802)

2. Patient cured or completely recovered from abnormality (37)

Information about unusual causes of pancreatitis, including absence of indication that running could be a cause, led physician to choose fasting therapy for 15-year-old patient who demonstrated pancreatitis while running in a race. Patient recovered completely and continued running, and there was no reoccurrence. (011401)
Information specifying the type of cephalosporin that is effective for treating gram positive pneumonitis enabled physician to replace ineffective treatment with a different cephalosporin as recommended. Patient recovered completely. (018801)

Information about ages of patients in a study of acyclovir treatment for herpes zoster led physician to conclude that a 30-year-old patient with this condition was too young to benefit from acyclovir treatment. Physician treated patient with prednisone, and patient's herpes cleared up. (011403)

3. Patient improved or stabilized (but not cured) of abnormality (34)

Absence of information about prior use of clot dissolvers during pregnancy led physician to decide against use of a clot dissolver (streptokinase) for a pregnant patient with a thrombosis (patient had a history of Hodgkin’s disease, and thrombosis was related to a Hickman catheter in the right subclavian artery). Physician successfully relied on heparin treatment instead. Patient is full-term and prognosis is good. (011202)

Information about use of tests for antiphospholipid antibody to diagnose hypercoagulability was used by physician to test a patient who had a stroke at an early age. Tests were positive, and patient was anticoagulated prophylactically to protect against future strokes. Patient's prognosis is fair. (010801)

Information about use of amantadine to treat patient with AIDS who acquired neuroleptic malignant syndrome after treatment with phenothiazine, was used by the physician and the patient recovered from the neuroleptic malignant syndrome, but still has AIDS. (U17803)
4. **No improvement of patient's abnormality (26)**

Recommendations for use of azelaic acid for treatment of acne were used by physician to guide treatment of acne with this drug. Physician does not believe treatment worked and no longer prescribes it. (016402)

Information about the location of an author of papers on use of an experimental drug therapy that had been used for low birth-height infants to stimulate growth was used by a parent of a 9-year-old child with a height problem to contact the researcher, who convinced the parent that the therapy would be worth trying. No change was noticed after a 6-month course of therapy, and it was discontinued. (048504)

Limited information obtained about seizures and other neurological complications being associated with flexeril overdose in rats, and absence of information about pediatric overdose, resulted in physician's reservations about stating that seizures and other complications found in a child who had overdosed on flexeril were definitely caused by the overdose, and left physician unable to specify an antidote. Patient was transferred to ICU, is still abnormal neurologically, and requires mechanical ventilation. (T01301)

C. **Symptoms (15)**

1. **Patient obtained partial or complete relief of symptoms (9)**

Information about a short-term, non-steroidal treatment strategy for arthritis pain that would not exacerbate a bleeding ulcer was used by physician to control patient's pain until surgery for the ulcer was accomplished, thus avoiding surgical complications, allowing surgery to occur sooner, and getting patient on methotrexate as planned. Patient is feeling less pain, but prognosis is guarded. (010901)

Information about therapeutic value and side effects of using an antidepressant (fluoxetine) for treatment of an unusual movement problem in adults (myoclonus) was basis for physician's
trial of small doses of fluoxetine for myoclonus in a pediatric patient. Treatment was minimally successful but safe, and physician is now using the treatment for an older child. (035403)

2. No improvement of patient's symptoms (6)

Information on the use of azelaic acid (dicarboxylic acid) in the treatment of acne showed the physician the dosage information and irritancy potential, which led him to begin prescribing the medication. He never prescribed it again, because he did not think there was any improvement in the patients' symptoms. (016402)

Lack of helpful information on skin allergies to white pigment led physician to be unable to improve the allergic symptoms which his patient exhibited to a white pigment which was part of a tattoo. (031301)

D. Function (5)

1. Role functioning of patient improved or protected (2)

Information describing adverse effects of propylthiouracil (PTU) treatment for hyperthyroidism, including the fact that effects are not time or dose dependent, led physician to decide not to grant waiver to woman on PTU with hyperthyroidism who was seeking employment on a government scientific vessel because she was still at risk for significant adverse effects. (031102)

Absence of information about treatment of dermatitis caused by fiberglass exposure led physician to prescribe symptomatic treatment for patients with occupational exposure. Treatment initially worked but poor compliance, plus constant exposure at work, led to relapses. (016403)

2. Role functioning of family improved or protected (3)

Information describing the increase in stress to the parents caused by not being with their child, who is in intensive care, and no increase in the incidence of infection in neonatal intensive care
when there was sibling visitation, led nursing staff to increase parent and initiate sibling visitation in neonatal ICU which improved the family’s attitude toward the child’s illness (U09101)

Case reports suggesting that the main reason to perform surgery for single-suture cranial stenosis in an infant is for cosmetic reasons, helped the physician to counsel the parents, although he could not give them a clear answer on the future shape of the child’s head. Physician advised the parents to take pictures, and if the child’s appearance changes, then he will perform the surgery. At the present time he looks fine. (U02803)

E. Process outcomes (303)

1. Patient or family knowledge, attitudes, and behavior (50)

a. Anxiety of patient and family relieved (13)

Information about an experimental drug for migraine headaches was provided by physician to M.D./patient with severe migraines who had heard of it, and helped reassure her that new treatments were being developed. (Patient decided not to pursue the experimental treatment because it was offered only at a distant medical center.) (040202)

Information on the death rates and complication rates from angiography during surgery for an angiofibroma of the nasal pharynx, which is a rare, bloody tumor that appears in teenaged boys, allowed physician to reassure the patient’s mother that it was likely her son would survive the surgery and, in fact, the tumor was removed without leaving a large facial scar. (065402)

b. Patient or family understanding of condition or health risk enhanced (26)

Recent information about the key pathological differences between acquired vs. familial hemochromatosis

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and about likelihood that other family members could have the familial type was used by pathologist to make a definitive diagnosis of familial hemochromatosis for a patient he had seen at autopsy and to provide information to physician for the patient's family. Family physician did genetic counseling with the family and is now performing biochemical screening on family members to look for serologic indicators that precede the condition. (031802)

Information relating a type of birth defect (chromosome deletion) to mild mental retardation was used by physician to counsel parents of a child with this defect about the mental retardation and the need to enroll the child in an infant stimulation program as soon as possible. (Parents did not return to physician for follow-up and outcome is not known.) (015001)

Basic information on non-Hodgkins lymphoma, including reviews which described the disease, how it differs from Hodgkins, its treatment and prognosis, was used by the physician to explain the lump in her neck, by using the abstracts as a brochure which could answer her questions. (P12403)

c. Patient/family involvement in treatment decision enhanced (7)

Absence of information on the usefulness of alpha-feto protein testing in pregnancy to detect fetal abnormalities led the physician to call a colleague to get the information so that the physician could tell his patient what her options were and the predictive value of the test (negative test tells which conditions can be excluded) and she could decide whether or not she wanted to have the test done. (T) (034802)

Information that suggested that colchicine may be effective for reducing
progress of cirrhosis in some end-stage patients, but is still optional and not a major loss if not used, led physician to inform his patient about his findings and the patient is deciding if he wants to have the treatment or not. (030301)

d. Adherence to treatment recommendations enhanced (4)

General information about hepatocellular carcinoma in children, including lack of relationship between the illness and hepatitis C, was used by physician in a small town in a remote area to educate parents of child with this condition before the child was sent to a major medical center for chemotherapy and surgery, and to help them properly care for the patient when he returned home. (Patient is doing well.) (041701)

Information about the lack of treatment options besides dietary control for hyperlipidemia in children, except for liver replacement in advanced cases, enabled physician to counsel the father of a child with this illness about the seriousness of the problem and to urge him to have the child followed carefully, which the father has been doing. (041702)

2. Health care (236)

a. Unnecessary treatments or procedures avoided, minimized, or reduced (40)

Absence of information about treatment of hepatorenal syndrome led physician to elect to forego all measures except to continue supportive therapy for patient. Patient's liver did not improve and patient eventually died. (011101)

Information that suggested that NMR is not better than catheterization of the pancreatic duct in the early detection of pancreatic cancer prevented patient in South America from having to come to the U.S. to have NMR of the pancreatic
duct performed. The catheterization was performed in South America and the patient had chronic pancreatitis, not a tumor. (063502)

Information that fish oil should not be used by diabetics to lower cholesterol, because the oil has negative effects on the diabetic's condition, enabled the physician to tell his colleague, who is a diabetic, to avoid using fish oil to lower his cholesterol, which he did. (053902)

b. **Risks or side effects of treatment avoided, minimized, or reduced (31)**

Information about the range of opinions concerning monitoring for liver damage with methotrexate therapy was used by physician to formulate monitoring strategies for patients on methotrexate therapy for rheumatoid arthritis and to educate patients about the need for monitoring. (011102)

Information about contraindications for gamma globulin treatment due to long-term potential for crossmatch problems in surgery were used by physician to stop gamma globulin treatment for patient with recurring respiratory infections who was receiving it unnecessarily for a low IgA condition. (Patient will receive specific treatment for her infections.) (010401)

Information on the use of carotid ultrasonography to measure bloodflow through the carotid artery, was used by the physician to recommend that his patient have this procedure performed, rather than the more risky, painful, and expensive arteriogram, to assess whether the patient had an internal carotid aneurysm. The patient had the test performed and did not have an aneurysm. (034901)
c. **Duration or frequency of hospitalization minimized or reduced without loss of medical benefit (5)**

Information indicating range of duration of abnormal cerebral spinal fluid values (for Group B Strept Latex) for a child recovering from Group B Streptococcus meningitis led physician with patient who showed abnormal values after 4 weeks of antibiotic therapy to decide that these values were not unusual for this point in the treatment and to discharge the patient earlier than anticipated. (Patient is doing well and seems to be developmentally normal.) (T03501)

Information indicating that sclerosing (injection of an irritant into the pleural cavity to create scar tissue) is a useful treatment for recurrent pneumothorax, and estimates of potential for success, led resident and colleagues to perform sclerosing procedure on hospitalized pediatric patient who was on long-term mechanical ventilation due to this condition. Patient went home after the procedure, and received procedure again 2 weeks later, after a pneumothorax episode. (Resident believes that patient has returned home.) (T07001)

d. **Patient received different and more accurate diagnosis than otherwise would have been obtained (49)**

Information indicating a high false-negative rate for a diagnostic test, and suggesting a more helpful test, was used by physician to aid in correctly diagnosing common duct disease (gallstone lodged in the common duct) in a patient with severe abdominal pain and previous cholecystectomy. (Subsequent surgery indicated that stone had already detached and the condition cleared by itself.) (011404)

Information about all possible causes of upper lobe bullous condition, including the fact that it is seen in IV drug
abusers, was provided by physician to a clinician with a patient with this condition to aid in diagnosis, and also aided physician in diagnosing his own patients who present with this condition. (029101)

Information linking thyroid deficiencies to depression was used by physician to test depressed patients for thyroid disorders, with the result that three times as many of his patients have been diagnosed with thyroid disorders. Appropriate patients are now treated for both depression and thyroid disorders. (010403)

e. Patient received different and better treatment or treatment recommendation than otherwise would have been obtained (75)

Absence of concrete information on the treatments that statistically yield the best results did not give the physician the support he needed to second-guess what the oncologists might tell him regarding the treatment of his patient with endocervical adenocarcinoma. They went ahead with surgery followed by radiation and the patient is doing well. (I) (062903)

Information that indicated that copper deficiency is signaled by a decrease in neutrophils, followed by sideroblastic anemia, and only occurs when zinc is given over long periods of time, convinced a clinical pharmacist that a critically-ill patient, who was receiving intravenous zinc for wound healing, was not in danger of developing a copper deficiency (there is a reciprocal relationship between the two), and is receiving better care because they now know what to look for. (074701)

Lack of information about the side effects of a drug, thymopentin, which a patient with colon cancer was considering taking, did not give the physician the information needed to
determine if this was a better treatment than the more traditional modalities; instead he called the manufacturer, who gave him little information because it was still investigational. (063503)

f. Patient received referral to appropriate specialist or treatment center (35)

Provided information to endocrinologist on relationship between diagnosis of adrenal masses and size when they are found (P10503)

Location of a specific reference summarizing classification, treatment, and prognosis of polypoid melanomas enabled pathologist presented with a skin specimen labeled "wart" that he subsequently determined to be a polypoid melanoma to present this information to the surgeon who had removed the skin, in order to familiarize him with treatment. (Physician is not aware of how the information was used by the surgeon.) (034001)

Absence of information about therapies for advanced metastasized bladder cancer led physician to move patient with this condition from oncology service to a tertiary care center that was better suited to care for him. (014401)

g. Patients received care where they otherwise would have received none (1)

Absence of information on non-psychiatric aspects of medical care for the homeless, which arose from a discussion a pharmacy administrator had regarding improper utilization of emergency rooms by the homeless, led his department to develop a program at a local shelter. Pharmacists go to the shelter weekly to work with the medical staff to educate the homeless on the appropriate ways to take their medications. They are providing medical care to patients who otherwise would be receiving none. (T02601)
3. Cost of care, insurance, and reimbursement (17)

a. Cost of care minimized or reduced without loss of medical benefit (4)

Comparison of side effects of the different beta agonists and their utility in managing premature labor led physicians to establish a treatment protocol that employed a less expensive drug. (P10703)

Information on the use of inhaled bronchodilator treatments for emergency room treatment of children with pediatric asthma resulted in the physician changing his practice from prescribing epinephrine injections and aminophylline drips, which would take 4-6 hours in the emergency room, to giving them inhalation treatments in the ER and at home, which is less traumatic for the child and results in less time in the emergency room. (U14401)

b. Insurance benefits and reimbursement obtained appropriately (13)

(1) Patient’s status with insurer decided appropriately (5)

Information indicating that while remissions of a type of end-stage renal disease (membrano-proliferative glomerulonephritis) do occur rarely, they usually end in recurrence of the disease, was used by physician to justify unwillingness to comply with patient’s mother’s request that physician inform the patient’s insurer that patient in remission is cured. (Patient is currently in remission but long-term prognosis is not good.) (040203)

Information about a technique for diagnosing cirrhosis was used by physician to do a more thorough analysis of liver enzymes for a
patient who claimed that he was being wrongfully labeled as an alcoholic by his insurance company. Physician had test done but has not yet seen the lab report. He believes the patient is honest, and that when it is proven that he is not an alcoholic, he will be spared a doubling of his insurance premiums. (034903)

(2) Reimbursement of patient and/or family for worker's compensation decided appropriately (4)

Information on neurologic injuries and the deterioration that can result, allowed a rural physician to understand the nature of his patient's neurologic impairment resulting from a skull fracture he sustained after falling off a truck several years before. The physician was able to present the information to the judge at the Workman's Compensation hearing to refute the insurance company's contention that the patient died from heart failure. The widow received the pension. (010802)

Articles documenting loss of pulmonary function after a stroke, led physician to counsel his patient that his pulmonary problems were a result of the stroke not related to his work and to give similar testimony in litigation his patient was pursuing against his employer. (013603)

(3) Problems or delays for patient in securing insurance reimbursement avoided (3)

General information about a rare cranial disease in children (Kronau's disease) aided company physician in preparing the company's insurance claims processors for timely approval of
the treatment plan for a child with this condition who was about to undergo surgery and home care. After surgery, patient's family was very pleased with the company's supportive attitude. (034904)

Information indicating that there is a connection between acute myocardial infarction and exercise or emotional stress was used by physician to support family's worker's compensation claim that cardiac patient's fatal heart attack was caused by his being forced to change a tire on the road; case was settled favorably to family out of court. (T05801)

(4) Reimbursement of provider for unaccepted treatment prevented (1)

Information on the official position of the American Academy of Allergy concerning Candida hypersensitivity syndrome allowed insurance company to deny claim for treatment (and presumably encouraged patient to seek further for appropriate diagnosis and treatment.) (P11203)

II. Research End Results (267)

A. New knowledge produced (16)

1. Theory developed or refined (6)

Information on the role of oxidative reactions in the process of differentiation in development was used by investigator to help interpret his own data and formulate a theory of the role of oxidative reactions in this process; investigator published an article on this topic based on his research. (028702)

Information on the pathophysiology whereby left ventricular hypertrophy potentiates heart ischemia was used by a researcher to provide
support for his hypothesis to explain their experimental findings; Investigator published an article on this topic describing their research. (T05201)

2. Basic biomedical knowledge produced (6)

Information describing differentiation caused by cAMP in various cell systems, but an absence of information describing differentiation caused by cGMP, led investigator to pursue an initial finding of differentiation in a certain cell line caused by cGMP; investigator has confirmed the finding with further studies. (Investigator has written up these results and has also developed a grant proposal on the topic.) (045802)

Absence of information discussing an association between two neurological diseases and expression of the ras oncogene led investigator to conclude that his discovery of this association in patients with these diseases was a new finding; investigator presented the results at a professional meeting. (046901)

3. Understanding of medical history or medical ethics enhanced (4)

Information discussing clinicians’ attitudes about the benefits of high-technology developments in cardiology, such as mechanical hearts and artificial prostheses, were used by student to compare these attitudes with those of medical historians who are concerned with the attendant ethical and financial problems; student will discuss the conflicts between these attitudes in a dissertation. (048901)

Additional information which the physician researcher had not heard about before, on physicians who are also writers (fiction or poetry) resulted in the citations being used in the bibliography of a book on this topic, for which the respondent was looking for a publisher. (042101)
B. New biological products developed (1)

Information on the gene sequence of ovalbumin (egg white) was used by a researcher to clone the gene into a plasmid and transform plants to produce ovalbumin with the ultimate goal of making these more nutritious plants commercially available. (046602)

C. Process Outcomes (250)

1. New research area identified (53)

a. Evidence of importance of research problem obtained (10)

Information describing a research finding on the role of calcium in induction of cell death by radiation confirmed the importance of this same research observation by an investigator, and led investigator to pursue research to identify calcium-dependent factors involved in cell death, because the initial research to confirm their existence has already been done. (056803)

Information obtained on the causes of reticulocytosis confirmed for the immunologist researcher that he had all the most up-to-date information, and could begin to investigate why 40% of the patients taking a drug in a clinical trial by his drug company exhibited this side effect. (051702)

b. Evidence of lack of importance of research problem obtained (3)

Absence of information showing the beneficial effects of systemic retinoids in the treatment of psoriatic arthritis, led the physician researcher to make the decision not to pursue the project to develop other drugs in this group, because there was not enough positive indication in was worth pursuing. (P10603)

Lack of specific studies addressing the question of why the rate of heart disease in France is so much lower than in other
Western countries, when their cholesterol levels were so high, resulted in the physician researcher dropping plans for the study because he found nothing exciting to explain the phenomenon except possibly the French might be underdiagnosing heart disease. (054302)

c. Need for further research determined (33)

Information describing increased mortality from heart attack in people with bundle-branch block, combined with the absence of information about the effect of thrombolytic therapy on heart attack in people with this condition, led investigator to begin a retrospective study of the effect of thrombolytic therapy on heart attack in people with bundle-branch block. (000501)

Information describing eating disorders (such as anorexia) in Asians outside of China, but an absence of information about eating disorders in China, led investigator to design surveys in Chinese to take along on a trip to China, with the goal of initiating a study of eating disorders in China. (017902)

Lack of qualitative information on parents' adjustment to home apnea monitoring convinced the nursing graduate student that there was good rationale for her conducting a study to measure parents' adjustment to having the monitoring device in their home with an infant at risk for sudden infant death syndrome (SIDS) and if she went on for a Ph.D., would develop the measurement tool. (U11002)

d. Need for preliminary research determined (7)

Lack of basic information on resources utilized in normal deliveries including labor nursing hours, supplies, drugs used, etc. to develop an assumed profile, led physician to conclude that there was a real need for preliminary research to get

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a good profile; the project is on-hold for the time being. (T01501)

Lack of any careful examination of the connection between lung diseases and aortic aneurysm, led physician to design and implement the project himself. He believes the results will have an impact on health care delivery. (063101)

2. Appropriate research design formulated (16)

Information describing studies of primary cilia in vestibular cells was used by investigator to help design experiments to investigate primary cilia in another cell type (cartilage cells) for incorporation into a grant proposal; grant was funded and work has begun. (012001)

Information describing general aspects of the existing health care systems in Central America, including numbers and types of facilities and extent of health insurance coverage, was used by investigators to design proposal to study how external funds provided to Central American nations for health care services are used; proposal was written and funded. (052606)

3. Methodological impediment to research progress removed (45)

a. New research methodology developed (1)

Descriptions of a method (seriolactin chromatography) for separating carbohydrates from proteins provided investigator who was making no progress using other techniques with a method for defining the carbohydrates attached to a protein (androgen-binding protein) being studied without damaging the protein. (049302)

b. Existing research methodology adopted (23)

Information describing methods for use of an antibody to stain a brain peptide (corticotropin releasing factor), including the animal species (rat) with which the antibody had been used in previous experimentation, was used by

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investigator to choose rats for initial experimentation with the antibody and to help design experimental methodology, and allowed investigator to begin immediately with experimentation instead of waiting for a personal response from investigator who supplied him the antibody. (Initial outcome from experimentation has not been successful, due to unknown reasons.) (013301)

Information describing the effects of passive smoking on children (including an association with cancer as children get older), and use of cotinine levels to measure smoke exposure, was used by investigator to prepare talk on effects of passive smoking and to design a study of baseline cotinine values in children. (033404)

Information describing techniques for in vitro phosphorylation of proteins by cAMP-dependant protein kinase was used by investigator as the basis for the methodology for his study of these proteins, instead of using a more standard method; grant proposal was written and is being revised for resubmission. (045801)

c. Existing research methodology applied to novel problem (15)

Information describing use of a cytobrush in Pap smear screening was used by investigator to modify protocol for study of cytobrush use in Pap smear screening; study was completed and results were written up. (034501)

Inability to retrieve a specific recent citation describing the reaction of a particular polyclonal antibody to a particular protein and the sequence of that protein led to the investigator calling the author of that paper; investigator used this information to design experiments to react the antibody to another protein he had recently purified; experiments were not
successful, and showed that the two proteins were not related. (I) (051003)

d. **Access to materials obtained (6)**

Identification of the source of new compounds that were purified from the fatty acid of the organism pseudomonas aeroginosa, which inhibited acetyl-CoA synthetase, allowed the researchers to contact the authors to acquire a sample of the compound. Without the information be could not have conducted his experiments because he needed a blocker of acetyl-CoA synthetase in order to show his effect was the result of transport not metabolism. (052401)

Identification of too much information made it difficult for the researcher to identify the appropriate benzodiazepine which he could use to block TRH receptors in the pituitary but do not enter the brain. (T01202)

4. **Interpretation of results clarified (7)**

Information describing negative clinical trials of therapies for cystic fibrosis for which there are an average of 14 patients in a study led investigator to suggest that these studies may not have the statistical power to support such negative conclusions due to the small number of subjects; investigator has written a paper evaluating negative clinical trials. (033401)

Information describing a reaction undergone by guanine methyl sulfate that blocks in vitro DNA synthesis was used by investigator to explain his own problems synthesizing DNA by treating cells with dimethyl sulfate; investigator was greatly relieved to find support in the literature for his experimental results and his student who is writing his thesis on this topic will cite this paper. (056601)

5. **Relationship of ongoing research to other/previous research clarified (42)**

Case reports of problems with polyethylene as a total-joint-replacement material were used by

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Data indicating that phenobarbital does not block long-term potentiation (LTP) in the hippocampus in animal studies was basis for investigator's conclusion that his drug currently under investigation, which does block LTP, is therefore different pharmacologically from phenobarbital; investigator was therefore spared the necessity of proving this experimentally and could proceed to other, more productive, experimentation. (054001)

Absence of information about scales used in nursing research to assess wound healing led investigator to continue search for this information, with help from a colleague; information was eventually retrieved, and used by investigator to develop a scale to assess the depth of a wound and to write a paper about this scale. (I) (057302)

6. Scientific communication prepared (46)

a. Research findings submitted for publication (24)

Information describing the use of a drukmeter to measure body water in humans was used by investigator to design study to measure body composition of paraplegics as it relates to their nutritional requirements; research was completed successfully and 5 or 6 papers were written documenting the results. (034402)

General background information describing research on the influence of non-steroidal anti-inflammatory drugs on blood pressure control, and a few articles specifically describing randomized prospective trials, were used by investigator to provide background for a paper documenting results of his research on the topic. (034801)
Information on isolation of the fungus which causes blastomycosis from beaver dam or fishing hut, was used by the veterinarian as background information when he submitted his paper documenting the results of his research on a new experimental drug for the treatment of the pneumonia caused by this fungus. (071503)

b. Bibliographical source documented (22)

Citation and abstract of a particular journal article on the effect of estrogen on glucocorticoid receptor synthesis in the pituitary was used by investigator to prepare for poster presentation of her own research, and to cite the article in the introduction to her presentation. (016001)

A couple of additional references that showed aging correlated to changes in cardiac function were used in physician researcher's paper describing his research on the relationship of aging with changes in renal function correlated with changes in cardiac function. (T00602)

Citations for approximately 400 articles on the topic of ethical dilemmas and newborns were used by doctoral student to present a comprehensive bibliography to his dissertation committee in support of the viability of his planned historical dissertation on the topic; the plan was approved and student has begun research. (048401)

7. Research support obtained (36)

a. Application for research support strengthened (25)

Information describing the expression of glycoprotein T-200 during differentiation of cells was used by investigator to support and strengthen research plan in grant proposal. (013803)
Information describing previous studies of a cytoskeletal protein in liver tumor cell lines was used by investigator to document assertions in a grant proposal; grant proposal was submitted. (Funding is pending.) (041601)

General information about factors affecting human fetal growth retardation was used by investigator to provide background for grant proposal in a new area of research; proposal was submitted. (Funding status is unknown.) (047701)

b. Application/review process facilitated (6)

Information describing research by a specific author (who was on the study section committee to review a proposal submitted by this investigator) was used by investigator to improve methods of glycoprotein analysis, and also reassured investigator that he had submitted his proposal to the appropriate study section. (013802)

Information on various methodologic approaches that could be used in the study of the control of fatty acid utilization by tissues and whether it is a biologically regulated process, and the feasibility of each approach, was used by a member of the metabolism study section, and his colleagues, to review the grant applications in an area which he would otherwise not be well versed. (74202)

c. Regulatory approval received (5)

An article describing a clinical study in which [new drug] was used for cancer treatment with reasonable safety was used by FDA regulator as basis for judgment that clinical trials of this drug for breast cancer (a new application) would be relatively safe; regulator granted approval to investigators who wished to begin trials of the drug. (049901)
Absence of any studies which were not contained in the application for approval to conduct a clinical trial of a new drug for breast cancer, convinced the physician working for the FDA that there were no selective omissions of negative studies, and the application was approved. (049902)

8. Appropriate participants secured for research project or conference (5)

Information on the research interests and prior collaborations of a neuroscientist, allowed a researcher to decide whether he wanted to collaborate with the individual before he spoke with him to see if his work was useful to his laboratory and to give him an awareness of his prior research. (074402)

Information on the latest references and research interests of suggested speakers, allowed physician researcher to review their work in light of the profile of the planned symposium on hypertension, and to invite them to participate. (024401)

III. Teaching End Results (249)

A. Direct instruction (classroom, wards, grand rounds, lectures) (172)

1. Students, residents, or local medical colleagues gained better understanding of topics in basic biomedical sciences (12)

Inability to locate a specific article about elevation in cyclic AMP in neuroblastoma cells led investigator to ask a colleague to supply him with this article that was too recent to be indexed in MEDLINE; investigator used this reference in writing a literature review on the effects of prostaglandins and beta-agonists on elevating cyclic AMP in neuroblastoma cell lines. (I) (030602)

Information from review articles on the six subclasses of colony stimulating factors, which affect cell proliferation, was used by an animal science researcher to present a lecture of a
group of graduate students in animal science, and provided a source of new information for both the instructor and the students. (013903)

2. Students, residents, local medical colleagues, or other health personnel gained better understanding of clinical care (106)

a. Gained understanding of particular disease or condition (pathophysiology, diagnosis, natural history, prognosis) (42)

General information on multiple myeloma was used by physician to supplement resident's talk on the disease, particularly the history of use of antimony compounds compared to modern treatments; staff gained a more complete understanding of the illness. (P12404)

Information indicating that gallbladder disease may predispose to heart attack, but not vice versa, was used by physician to determine that a patient with a heart attack and right upper abdominal quadrant pain did not also have gallbladder disease, to direct treatment accordingly, and to instruct students; students learned about the reflex relationship between the gallbladder and the heart. Patient eventually recovered. (T03702)

Absence of information describing clinical studies, as opposed to animal studies, of proximal disorders in children and adults hampered physician's ability to prepare grand rounds presentation on a patient with proximal disorder and also to choose treatment for the patient; physician will reattempt search using "human" as a limiter. (I) (036401)

b. Gained understanding of (new) diagnostic procedure (e.g. indications, procedures for performing, interpretation of results) (13)

Information about use of ultrasound for diagnosing carotid artery disease was
c. Gained understanding of management of a particular disease or condition (e.g. use of certain therapies, overall care of the patient, risks involved in management) (9)

Small amount of information published since 1983 about use of 6-mercaptopurine and azothyoprin for Crohn’s colitis and ulcerative colitis demonstrated to physician that the most important research on the topic was done in the 1960s and 1970s, and that little new research was done in the 1980s; physician used this information to present a lecture; medical students gained an understanding of the topic. (P10402)

Information on the different categories of mothers’ reactions to an unexpected caesarian birth, and the role of success or failure on breast feeding in dealing with the negative feelings, resulted in the nurse being able to provide childbirth educators with specific techniques to identify those women who need assistance and what interventions to employ. (U14502)

d. Gained understanding of (new) therapeutic procedure (e.g. indications, dosage, efficacy, risks) (19)

Article illustrating malpositioning of various types of catheter tips was used by
physician for teaching; residents learned to read films to identify malpositioning and learned about potential complications of malpositioning; article also served as a permanent reference for these residents for future use in training and practice. (029102)

Inability to retrieve citations for all of the new cooperative studies on use of Levine or peritovenous shunts in treatment of ascites of which physician was aware resulted in physician directly contacting investigators who had performed a particular study; physician used data obtained, plus other data obtained through the search, to deliver lecture; members of journal club gained an understanding of the topic. (1) (P10403)

e. Gained understanding of specific issues in health care delivery (organization of services, role of providers, role of patient and family) (17)

Information obtained on group therapy for families of children with cancer, allowed a social worker to gain an understanding about families where children have cancer and could speak to a class for clinical social workers. (T04502)

Information obtained on how other institutions and physicians are confronting the situation of how to determine brain death, was used by physician to make residents more aware of the issues. (038803)

f. Gained understanding of specific issues in disease prevention (6)

Information about the chronic effects of indoor air pollution on children allowed the physician to gain an understanding about these effects and resulted in his being offered a position. (067902)
Information on the methods of transmission of Clostridium difficile infections in a hospital setting, led infection control monitor to create more stringent controls on staff cleanliness, through more staff education. There were no more outbreaks since the changes. (U11302)

3. Students, residents, physicians, or other health care personnel gained ability to access biomedical literature (42)

   a. Gained appreciation of value of on-line medical information service for clinical care or research (12)

   Retrieval of a collection of recent citations about cardiac assist devices in animals was used by physician to help graduate student develop a bibliography for her master’s thesis on this topic. (P10805)

   Retrieval of a series of articles on a blood coagulation problem due to protein C deficiency, provided the resident with an opportunity to see how quickly he could gain access to information on an unusual clinical problem using an on-line database. (070001)

   b. Gained better access to current literature in their specialty (9)

   Collection of all citations in MEDLINE for the past three years from 6 major journals were downloaded into a microcomputer by physician for use by medical department; residents in department use this database regularly as a reference. (P10806)

   A retrieval of all information on surfactant and its associated proteins, led physician gain a better perspective on surfactant research and will now have an ongoing literature search updated monthly, to keep current in this area. (U13901)
c. Gained better access to broad-based bibliographic information (11)

Large number of publications on the national impact of ritodrine tocolysis (drug therapy for inhibiting premature labor) allowed the physician to prepare a report documenting the number of articles written on this topic per year over the past fifteen years, to support the increasing interest in ritodrine therapy over this period. (T05501)

Information from 40-50 articles on lead poisoning and trauma, allowed physician to have a more complete information base with which to discuss his patients, in his chapter in a book on lead intoxication from retained missiles such as bullet fragments. (T03001)

d. Gained better access to biographical information (10)

Identifications of the complete bibliography for a visiting dignitary led the researcher to download all the citations and distribute the bibliography to everyone in the department before he gave the lecture. (052601)

Identification of some new papers on photactivable labelling by a researcher in France, allowed the molecular cell biologist to keep up-to-date on the research interests of this individual. (025203)

4. Lay public gained understanding of health issues (12)

a. Gained understanding of use and possible risks of particular medical therapies (4)

Absence of information on specific treatment for fire ant bites led the physician to inform [youth organization], who requested the information, that there is no specific remedy for fire ant bites other than treating the symptoms. (T05802)
Information on the increased incidence of falls in older people who are taking benzodiazepines, was included in the medical writer's consumer book on prescription drugs in older people. (055301)

b. **Gained understanding of the positive outcomes or risks of particular health habits and behaviors (6)**

Information describing incidence of use of smokeless tobacco in adolescents and health implications aided rural dentist who was a student in a public health program in preparing a paper on the topic, and led him to design a survey of use in middle schools and high schools, to deliver information on the topic to medical societies, health departments, and schools, and to counsel patients more vigorously against use of smokeless tobacco. (043001)

Information that a high fat diet is correlated with an increased incidence of breast cancer, and that vitamin A and E supplements decrease the risk of cancer, was used by the physician in community talks and the nutritionist used the information to counsel patients, who have already had breast cancer; some patients have followed through and changed their dietary habits. (U19702)

c. **Gained understanding of other general health issues (2)**

Information on definitions of the value of humor in medicine and the names of critical workers in the field, allowed the physician to network with the individuals to access the latest information and prepare his talk for the public on the emotional aspects of cancer, laughter, and medicine. (U19403)

Information on children of the survivors of the Holocaust was used by the
B. Professional writing (textbooks, non-research articles, case reports) (74)

1. Wide professional audience gained better understanding of clinical care

a. Gained understanding of particular disease or condition (pathophysiology, diagnosis, natural history, prognosis) (25)

Information about Merkel cell tumors of the skin and their immunohistochemistry was used by physician to document a case study of this life-threatening condition seen in one of his patients. (028701)

Information about the natural course of B-cell lymphoma of the skin, diagnosis, and treatment was used by physician to document a case study of this rare and life-threatening condition seen in one of his patients. (028703)

Lack of information citing titles of books on food allergies, led physician to ask medical librarian to search CATLINE, in order to get the titles, to settle an argument between the physician (author), book sponsor, and publisher, on what the title of his book should be, so that the book could be published and provide new information on food intolerance in infants. (070601)

b. Gained understanding of (new) diagnostic procedure (e.g. indications, procedures for performing, interpretation of results) (13)

Inability to locate articles specifically describing test results in children with cochlear implants (search yielded many articles on other types of auditory prostheses) led physician to use another method to locate articles on this topic; physician wrote a paper on the topic. (I) (030803)
Information on new staining techniques used in diagnostic cytochemistry of acute leukemia were used by the pathologist in his book on the subject. (063302)

c. Gained understanding of management of a particular disease or condition (e.g. use of certain therapies, overall care of the patient, risks involved in management) (6)

Information on lymphocyte pathophysiology and its role in kidney and heart transplant rejection allowed a nephrologist to prepare the manuscript and present his talk to a national seminar updating physicians on the management of transplanted organs. This was a very hot topic because certain of these lymphocytes are transferred during transplantation and react causing rejection graft vs. host disease. (T07801)

Lack of information on the use of certain medications, such as nitroglycerin, to dilate blood vessels during microsurgery, resulted in surgery preparing a paper on his experience using these medications as an aid in repairing the vessels during microsurgery, such as reattachment of severed fingers. (U06201)

d. Gained understanding of (new) therapeutic procedure (e.g. indications, dosage, efficacy, risks) (20)

Information on drugs which are toxic to the kidneys, including the startling information to the physician that indomethacin is toxic to the kidney of the fetus, was used as part of a review article on drugs that are toxic to the kidney. (058502)

Original source which said that gastric freezing was good, and a later one which stated that it was terrible, provided both points of view in a review article on gastric freezing, which was a technique to stop gastric bleeding, but was

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abandoned because by the end of a year the patients bled again. (077901)

A series of articles on sclerosing agents, duration of wrapping, and wrapping techniques, helped physician prepare a paper and a talk to a national audience on his experience with scleral therapy for varicose veins. (U00501)

e. Gained understanding of specific issues in health care delivery (organization of services, role of providers, role of patient and family) (3)

Studies of attitudes and beliefs toward aging and the elderly on the part of society in general, the aged themselves, and health care providers were used by investigator to prepare a literature review of the topic. (013402)

Information on individual DRG's and how they impact on the hospital as far as remuneration, possible impact on care, and death rates and readmission rates in nursing homes were used by physician to write a 10-page summary and 300-citation bibliography on the quality of care in the Peer Review Organization which formed the basis of his testimony before a congressional committee. (063001)

2. Wide professional audience gained access to clinical observations and case reports (7)

Information which indicated that while Cogentin has been reported to be helpful in the treatment of neuroleptic malignant syndrome, there is not true drug therapy for the condition and if the neuroleptic drug is withdrawn, the patients get better, contradicted the physician’s experience where treatment with Cogentin caused dramatic improvement in the patient, which she reported in a case report. (U08801)

Lack of substantial reports of patients who visit a doctor for lower back pain, and in the course of the workup are found to test positive for AIDS, resulted in the orthopedic surgeon writing up a case report of such a patient so
that other spine surgeons would be made aware that AIDS is a possibility in patients with back pain. (T07901)

C. Physician's own understanding (3)

Information obtained on a monthly basis on CPR and emergency cardiac care led the physician to increase his understanding of the newest trends in the area, such as new treatment or education modalities, which he can use in a variety of his professional activities. (U00701)

Information on Forcious Erikson ocularomnis, was used by ophthalmologist to keep himself current on the subject, since he was nine months behind in reading Current Contents. (36403)

IV. Administrative End Results (102)

A. Physician's own practice (27)

1. Physician altered care for specific condition (20)

a. New protocol/standards adopted by physician (14)

Information which discussed the rates of positive needle localizations for malignancy based on the results of mammography showed the physician where he should change his practice in terms of reading mammograms and determining the indications for performing a needle biopsy. Instead of biopsying when there were three calcifications, the literature suggested biopsying if the patient has five or more. He also found that his positive for malignancy rates after biopsy were in line with the national average. (P12102)

Information on a newly marketed bronchodilator for the treatment of childhood asthma resulted in the physician changing the way he manages his patients. He now uses agents which are more selective for bronchodilation, rather than the more general drug he was taught to use as an intern. (T01801)
b. New equipment/technology adopted by physician (6)

Information on the test results, testing protocols, and reliability and validity of the various machines to perform isokinetic testing, led physical therapist to purchase and utilize two pieces of the this equipment, one for testing backs and another for lower extremities. (T05301)

Lack of information on the utility of newer blood counting machines, especially with respect to mean platelet volume, led physician to delay making a decision on whether to purchase one of the new machines. (I) (P30402)

2. Appropriate future employment pursued (6)

Identification of an article by another investigator on using biochemical methods to study neuronal development in a journal that the researcher did not normally read (he was a biochemist, not a cell biologist), led the researcher to find out more about that investigator's work, and interview with him for a fellowship position. The researcher liked the approaches used in that laboratory and made the decision to accept a position. (051002)

Identification of several groups that were doing work in neurobiology with some interface with the immune system, a topic relevant to the research interests of a rheumatologist/immunologist, led him to talk with other experts about their opinions of the different laboratory and enabled him to make a decision on the laboratory where he would spend his sabbatical. (068802)

3. Physician's personal business endeavors did not benefit (1)

Absence of information on implants of anabolic steroids for weight gain in cattle, led the veterinarian to continue to use the recommendations of the feed lot operators in his cattle-raise business. (I) (043403)
B. Hospital (66)

1. Personnel matters successfully resolved (2)

Bibliography of publications by a physician who was an applicant for an attending position at a hospital was provided by research assistant to the person who would by interviewing the candidate. (049401)

Retrieval of the bibliography of an associate, which contained only one case report in the past 20 years rather than the extensive bibliography which he claimed to have, resulted in a re-evaluation of his honesty. (P11202)

2. Hospital adopted or altered protocol/standards of care for specific condition (40)

Recent national mortality statistics referencing birthweights and death rates at different gestational ages were used by investigator to compare with similar statistics from his own hospital for the purpose of publication and for analysis and potential revision of the hospital's standards for ultrasound identification of growth-retarded fetuses. (011203)

Information from a wide variety of journals on the causes of urinary tract infections led physician to develop a questionnaire to administer to his female patients who have urinary tract infections which addresses all sources of the infection. This has improved the physician's ability to track and prevent urinary infections in his patients. (066602)

Lack of specific information on the safety and efficacy of using sodium bromide in the treatment of seizures in pediatric patients made it more difficult for the Pharmacy and Therapeutics committee to approve its addition to the formulary. Ultimately its use was approved, but only in restricted cases. (044001)

3. Hospital continued to use existing protocol/standards of care for specific condition while maintaining quality of care (17)

Information describing animal studies of use of LHRH analogs for management of uterine
fibroids, but an absence of human studies advanced enough to provide a standard of care on this issue, led physician on a clinic committee to decide that LHRH analogs are not yet a viable option for management of uterine fibroids. Committee eliminated LHRH as a possible alternative to surgery in its guidelines. (019402)

Lack of information on proper dosages of heparin to prevent deep vein thrombosis, led physician and his colleagues to continue to use their existing protocol, since they had no evidence to prove that it would be helpful to change to a new prevention protocol. Physician did not believe they had a higher incidence of deep vein thrombosis with their current protocol. (I) (T07701)

4. Hospital set up new facility/service (7)

Broad-based information on demographics, financial operations, and models of children's hospitals convinced the hospital administrator to support the arguments put forth by the pediatricians of the need for a separate children's hospital. (U09502)

Articles chronicling the prevalence of substance abuse among the chronically mentally ill and treatment models which have been used resulted in a mental health agency quickly setting up a program to accommodate schizophrenics and other chronically mentally ill who have substance abuse as their main problem. (U04801)

C. Other institution or organization (9)

1. Personnel matters successfully resolved (1)

Identification of a large number of recent articles by a researcher in a subject area medical school was interested in including on their faculty convinced a chairman of the search committee to invite this previously unknown researcher to present a seminar and discuss one of the department's job openings. (048501)
2. Government program policy established or revised (8)

Absence of new information concerning community health effects of disposal of solid wastes from hospitals reassured county health department employee that his research on the topic was exhaustive. County employee informed state health department that proposed new state regulations to treat medical wastes as hazardous wastes were excessive and would place unnecessary burden on hospitals. State altered proposed regulations and labeled hospital wastes special wastes instead of hazardous wastes. (T04801)

Absence of new information on screening for and identification of children with dyslexia assured physician-administrator of a public school district that the district did not need to change its current procedures. Physician developed a policy that put school district into compliance with latest state law without changing the screening method itself. (T00201)

V. Legal End Results (22)

A. Patient or physician effects (8)

1. Patient protected from adverse decision (2)

Information on the complications of thoracic outlet syndrome and its surgical management was used by a surgeon to provide testimony to support a patient's claim of lack of attention to detail by another surgeon who had operated on the patient, an operation which resulted in injury to the ulnar nerve and partial paralysis. (U11903)

Lack of information on the causes of spinal cord infarction after surgery did not provide the neurologist with enough information to counsel the patient's lawyer in a case involving a patient who developed paraplegia following abdominal surgery in the retroperitoneal area. (I) (021103)
2. Physician protected from unwarranted legal action or adverse decision (6)

Identification of articles from surgical journals on the use of actuarial statistics in medicine will allow psychiatrist to refine his approach to courtroom testimony in that when he is asked to make a prediction, he will make a more considered and elaborate response. (063803)

Information that indicated that in 1977 there were published articles that indicated that cryosurgery was appropriate as a treatment for basal cell carcinoma, allowed the physician to pass the information along to the attorney defending a physician against malpractice who used this procedure on a patient with the condition in 1977. (019602)

B. Legal process (14)

1. Time and expense of questionable suit avoided (12)

Information indicating that Stoddard’s solvent and similar solvents were linked to hepatic cancer in rats, but that there was no documented link to hepatic cancer in humans, was used by epidemiologist to counsel family of patient who had died from liver cancer that occupational exposure to the solvent was probably not the cause of his illness, and that there was not a reasonable justification for them to take legal action to pressure the company to change the work environment or to sue the company for damages. Family was very reassured by this. (T03701)

Information that suggested that occasionally congenital hip problems are not picked up until the child begins to walk, even though they had routine testing at birth, allowed a physician to pass the information on to child’s mother’s lawyer to give him the background to build a defense that there were no grounds for a suit on the basis of neglect simply because the hip problem was not found until the child started to learn to walk. The case was dropped. (062902)
2. **Offenders tried on appropriate grounds (1)**

Information that indicated that the entire concept of the "shaken baby syndrome" was based on one article, and that there was no scientific basis for the premise, convinced forensic pathologist that it should stop being used as a defense for defendants in child abuse cases (i.e., the lawyer tells the jury that the client-parent just "shook" the child, when in fact, the parent probably threw the child). (T04301)

3. **Illegal business closed (1)**

Physician was asked to prepare a written accusation for the state medical licensure board regarding a business that advertised a high colonic (washing out the colon) as a cure for colon cancer, diverticulitis, and colitis. Failure to obtain information on "colon hydrotherapy" meant that physician could not include information on any recognized detrimental effects of the colonic washouts, but the business was closed for practicing medicine without a license. (I) (U14902)

VI. **Outcome unknown or not yet determinable (56)**
APPENDIX I

SUMMARY OF ANALYSIS
OF INEFFECTIVE SEARCHES
User Comment on Search

1. I couldn't find article. (012602)

2. I didn't find the paper I was looking for. The paper was too recent--it may have been in press. (013801)

3. There was nothing current or anything that would pinpoint a direction we should be going in, for this retinal binding protein. If it's being published, it's being covered in journals not covered by the ELHILL system. (013901)

4. I got 30 articles on adolescents as far as the immune system being disrupted that were not what I wanted. I found no new sources that had any useful information that I needed. (021202)

5. I got information that was totally irrelevant. (021203)

Analysis of Search and Results

Searcher did not go beyond the current MEDLINE file to find the specific citation so missed it. Searcher did not make use of MeSH for the topic-used only a text word (hispanic) rather than hispanic americans. Missed one subject area of inquiry.

Search was fine, but paper the searcher was seeking was probably too recent to be in MEDLINE.

Searcher took a very narrow approach to his search and ultimately reached the wrong conclusions about the availability of information in the file. He used too few MeSH trees. He should have looked at vitamin a in addition to vitamin a deficiency. Interview indicates that he said he did a lot more searching than the log reflects.

The searcher missed finding a whole body of citations in his search because he did not use the MeSH tree pertaining to adolescence. He did not use MeSH to narrow his search to psychological issues. The transaction log shows a lack of knowledge of MeSH.

Searcher ultimately found the correct MeSH heading and did a good search. Searcher wished that Grateful Med had told him that cat scratch had to be entered as a hyphenated word.
6. I got too much animal work. I got so much I really got nothing--there were too many irrelevant articles to review. (036401)

7. I couldn’t get the information I wanted, with the restrictions I put in. (036402)

8. No breakdown that separated this condition from general ventricular tachycardia. Abstracts only mentioned Torsade de Pointes even though I specifically searched by MeSH heading Torsade de Pointes. (039301)

9. I never found article I was looking for. (042202)

10. Fellow found out later from the transplant surgeons that the literature he wanted was in transplantation proceedings. He found no evidence of relationship to Epstein-Barr. (060402)

11. None of the papers were on the mark—we got only papers where the phenomenon in vitro was studied, instead of in vivo. (061303)

12. This is a rare phenomenon in children. I could not cite a similar case for the clinician or tell how a patient was treated. (065801)

Searcher did an effective search. One category of literature might have been omitted from his search due to his strategy (microbodies), but the search turned out fine.

Search was very simplistic. User claimed that he used MeSH when the log shows he did not. Not using MeSH was a serious problem.

Searcher used a term that was cross-referenced to another broader term and retrieved many articles that were not related to his term specifically. The system did not tell him that his term was being mapped to a broader term. (Torsade de Pointes is a ‘see’ reference to tachycardia).

This was a good search. Could be that MEDLARS didn’t index the journal. Interviewer should have probed for the specifics of the sought-after article.

Searcher was too narrow in his approach to the search and missed retrieving potentially relevant materials. He did not explode the lymphoma tree and thus lost a number of references. He was inconsistent in entering the text words he selected when searching across files.

Searcher did not use MeSH. Used one term and then a text word. The search was too narrow because of the text word.

Interview indicates searcher issued commands that are not shown in the transaction log. Should have made use of MeSH trees. Too narrow a search by just using text words. Should have searched CANCERLINE and did not.
13. I confirmed I didn’t miss any in the past, but I don’t know how many papers have come out more recently. I couldn’t tell how much I missed. (067402)

14. No information was obtained. (032703)

15. I couldn’t find literature that provided good peer review of PCA. But the topic is so new that I may be on the forefront of experience. (044801)

16. We didn’t learn anything more about other diseases with similar symptoms to measles. (045302)

17. I couldn’t access what I really wanted. I have a feeling there should be much more articles out there that specifically address my concern. (062203)

18. I didn’t have my questions answered. I assume there is literature that will answer my questions, but I don’t know where it is. (011402)

Searcher should have searched the AIDSLINE file but did not. MeSH indexing fairly good on the topic but he did not demonstrate in his search that he knew how to use it.

The documents related to his topic were indexed in two different ways in MEDLINE. To have found both sets he needed to broaden his search strategy. He also needed to search CANCERLINE as well as MEDLINE. He limited the search to English which got rid of the one relevant article he found with his search strategy.

Searcher used the wrong MeSH headings even though he called NLM to find out the correct ones. He used the term self medication instead of the term self administration, which was the one NLM suggested.

Searcher’s report on the search and the log of the search do not coincide. He was looking at the relation between measles and two other viruses but he only did his search with the term measles and limited it to the subheading prevention and control.

MeSH indexing is widely scattered on this topic. Did have one fairly effective strategy but by the vicissitudes of the indexing he missed some useful articles. Did search the correct file.

Searcher did the search reasonably correctly, but did not look at the results of one search statement that would have contained the best information. Did not explore all facets of his search request. Quit searching before exploring all avenues.
19. It’s really hard to believe that nobody’s done any articles on this subject. Or, it may be that they’re classified and indexed in a different way. It’s frustrating not to be able to access articles in your own field. (025903)

20. It wasn’t relevant information for my needs. (026702)

21. Grateful Med didn’t give me what I was looking for. I had to go to BRS Colleague to find the information. (026901)

22. Only two articles were anywhere near relevant. It was unsatisfactory in that I got three that were not related. (034002)

23. I got nothing fruitful for our purposes. (037602)

24. I didn’t find out what I wanted to know about the pathology of lymphoblastic lymphomas. (067703)

25. None of the articles I found quite addressed the problem I was trying to solve. It was not clear whether or not people had looked for those receptors on cancer cells. (070502)
26. It did not give me the information I wanted. I realize now that this was because I was asking for book titles and MEDLINE was dutifully trying to give me journal articles. (070601)

Searcher needed book titles. Used MEDLINE instead of CATLINE but discovered the error himself and redid the search later.