

---

# The impact of the hospital library on clinical decision making: the Rochester study\*

By Joanne G. Marshall, Ph.D.  
Assistant Professor

Faculty of Library and Information Science  
University of Toronto  
140 St. George Street  
Toronto, Ontario, Canada M5S 1A1

---

In these times of economic constraint, libraries of all types are under increasing pressure to evaluate their services. Hospital libraries face a particular challenge because the goals of the health care system demand that the relevance of library services to patient care be determined. The hospital librarians in Rochester, New York, responded to this challenge by developing a research project that explored the impact of library services on clinical decision making. A systematically sampled group of 448 physicians in the Rochester area agreed to participate in the study between September 1990 and March 1991. The physicians were asked to request some information related to a current clinical case and then to evaluate its impact on the care of their patients. Senior medical staff or administrators acted as study facilitators in each of the fifteen participating hospitals. As a result of the information provided by the library, 80% of the 208 physicians who returned their questionnaires said that they probably or definitely handled some aspect of patient care differently than they would have handled it otherwise. Changes in the following specific aspects of care were reported by the physicians: diagnosis (29%), choice of tests (51%), choice of drugs (45%), reduced length of hospital stay (19%), and advice given to the patient (72%). Physicians also said that the information provided by the library contributed to their ability to avoid the following: hospital admission (12%), patient mortality (19%), hospital-acquired infection (8%), surgery (21%), and additional tests or procedures (49%). The physicians rated the information provided by the library more highly than that provided by other information sources such as diagnostic imaging, lab tests, and discussions with colleagues. In addition to confirming earlier research findings that information provided by hospital libraries is perceived by physicians as having a significant impact on clinical decision making, the results increase our store of scientific knowledge about the specific nature and extent of the impact of information provided by the hospital library.

---

## BACKGROUND

A change in a U.S. federal regulation passed in 1986 by the Health Care Financing Administration (HCFA), that eliminated the requirement that hospitals main-

tain a library to be eligible for Medicare and Medicaid funding, continues to concern members of the health care community. The original federal legislation of October 4, 1966, required, as a condition of qualification for provider agreements under Medicare and Medicaid, that hospitals "maintain a medical library according to the needs of the hospital." Because individual states are required to have regulations at least as stringent as the federal legislation, Section 405.1030 of the New York State Code, effective July

---

\* This research was supported by grants from the New York State Education Department, Division of Library Development, Hospital Library Services Program, Rochester Regional Library Council, Rochester, New York, and the Medical Library Association.

25, 1977, included the library requirement. On June 20, 1980, HCFA gave a notice of proposed rulemaking (NPRM) to conduct a review as part of its efforts to reduce the burden of federal regulations. After the review and comment period, a second NPRM was published on January 4, 1983, but the recommendations of those who commented in favor of hospital libraries during both reviews were ultimately rejected. Instead, HCFA stated its belief that the decision to maintain a health sciences library should be left to the individual hospital, and that "the existence of information without a parallel requirement to use it" does not ensure improved patient outcomes. Thus, the requirement for a health sciences library was not retained in the revised code of June 17, 1986 [1].

The New York State Department of Health determined that it could not justify a higher standard than the federal government's, and effective October 1, 1988, New York also eliminated the health sciences library requirement. In correspondence with the president of the Upstate New York and Ontario Chapter of the Medical Library Association (MLA), a representative of the department wrote, as justification for the decision, that the department could not find a "useful linkage" between the requirement for a hospital to maintain a health sciences library and any problems that occurred with the delivery of hospital patient care and services [2]. A more recent letter from the department indicated that the policy and practice followed in the revisions to the regulations reflected the department's "expectation for the delivery of patient care and services in terms of performance and patient care outcomes rather than indicating structure and process" [3]. Only in areas where the department's experience had proved that a specific process or procedure was necessary to ensure high-quality care in all cases did the department specify detailed staff and process requirements. The principal interest of the department was stated as the protection of patients and the promotion of quality patient care, not education, management, or research, directly.

The HCFA decision and that of New York State clearly indicate that hospital librarians need to consider new approaches to evaluating their services. Traditionally, hospital librarians have relied upon the type of input measures found in hospital library standards documents to evaluate their services [4-5]. Other approaches have stressed output measures for special libraries that evaluate the efficiency and effectiveness of library activities, such as the reference service delivery rate or cost per cataloged item [6]. Value studies of library services conducted by the Special Libraries Association have measured time saved and actual monetary savings for organizations, and provided anecdotal evidence of the value [7]. The issues involved in evaluating the impact of hospital library services in particular have been discussed by

Hardy, Yeoh, and Crawford [8]. There have been important reports in the literature that show the impact of specialized services, such as those provided by clinical librarians [9-11], library-supported continuing medical education [12-14], and MEDLINE [15]. However, the research question of the impact of regularly provided hospital library services is a somewhat different one. The current situation in the health care regulatory sector suggests that, while librarians should continue to build a case based on a variety of approaches to the evaluation of libraries and other specialized services, additional studies of the impact of general hospital library services on patient care are still needed.

### THE ROCHESTER STUDY

An objective of the Rochester Regional Library Council (RRLC) Hospital Library Services Program (HLSP) for 1990-1991 was "to encourage hospital libraries to develop methods of analyzing current user services in order to improve the visibility and status of the library." In light of this objective and the current regulatory situation in New York State, the HLSP Advisory Committee asked the author to conduct a study in the Rochester area that would address this new evaluation challenge. The Upstate New York and Ontario Chapter of MLA, which had identified research as a goal in its strategic plan, was also supportive of the initiative. The study was a grass-roots effort that would not have succeeded without the commitment and cooperation of all the participants. The Rochester hospital librarians and the RRLC special projects director worked closely with the university-based research director to define the nature of the study, to select the research design, and to develop the measurement instruments. At a meeting of the hospital librarians on March 16, 1990, the meaning of the terms *value* and *impact* as applied to information in the hospital environment was explored. The group agreed that in health care settings, the bottom line was impact on clinical decision making. The decisions made by health professionals in the course of patient care are critical to the quality of care and to health care outcomes. If the library wanted to demonstrate its direct contribution in the health care environment, then the study would have to measure the impact of information provided by the library on clinical decision making.

After discussing possible research designs, the group agreed that it would be advisable to build upon an earlier Chicago study of the contribution of the hospital library to clinical care [16]. In the Chicago study, 310 randomly selected health professionals from eight hospitals were asked to request from their hospital library some information related to a current clinical case. After receiving the information, the

health professionals were asked to complete a two-page questionnaire and mail it back to the research director at the University of Illinois. The Rochester group decided to use the Chicago study as a base for several reasons. The earlier study focused on the impact of hospital library services on patient care, which is closely related to clinical decision making; the Chicago study's research methodology had many desirable characteristics of scientific validity and reliability; a measurement instrument that could be a basis for the Rochester study instrument had been developed and pretested in the Chicago study; David King, the research director of the Chicago study, was willing to work with the Rochester group as a consultant to adapt, refine, and improve the existing methodology and measurement instrument; and the study was feasible, given the high level of cooperation among the health sciences libraries in the Rochester area and the time and resources available.

The Rochester group met with King on July 26, 1990, to discuss the Chicago study and to begin revising the methodology and instrumentation. Several important points about the original study design raised during this meeting affected the procedures followed in the Rochester study. First, King reported that several other groups of health sciences librarians had attempted a replication of the Chicago study, but low response rate had often been a problem. He pointed out that some of the groups with low response rates had not contacted the health professionals in advance to ask them to participate. Also, some groups had not placed identification numbers on the questionnaires, which made it impossible to send follow-up letters to nonrespondents. This discussion made it clear to the Rochester group that considerable time and effort would be required to obtain an adequate response rate. The librarians agreed that the response rate might be increased by obtaining letters of support from the local medical societies; a member of the group agreed to explore this possibility.

King stressed the importance of the role played by the health professionals who acted as study facilitators in each hospital. The facilitators in the Chicago study had a great deal of responsibility. They were asked to select the health professionals for the study randomly, to call those selected and ask for their participation, to distribute the study packets, and to remind nonrespondents to return their questionnaires. In the Chicago study and its replications, obtaining full cooperation from all the facilitators had sometimes been a problem. Considerable discussion ensued about how the role of the facilitator could be made less onerous in the Rochester study, and a decision was made to hire a research assistant who would carry out as many tasks as possible. These discussions and King's contribution to subsequent discussion about the extension and revision of the measurement

instrument, greatly enhanced the Rochester study design and implementation.

## SAMPLE

All fifteen hospitals in the five-county Rochester area participated in the study. Seven of the hospitals were in the city of Rochester, and eight hospitals were in surrounding rural communities served by a circuit librarian program. Unlike the Chicago study, which included a variety of health professionals, the Rochester study was restricted to active physicians and residents who were affiliated with the participating hospitals. This decision increased the homogeneity of the study population and made it easier to obtain lists of potential respondents. Considerable work was required on the part of the Rochester librarians to remove duplicate names of physicians who were affiliated with more than one hospital. In such cases, the librarians established the physician's primary affiliation and then removed the name from the other lists. Once these lists were prepared, the research director was able to determine the total population and to calculate an appropriate sample size. Initial counts indicated that there were approximately 2,750 physicians in the population. A table of sample sizes (in which a maximum or minimum occurrence rate in the population was not estimated) indicated that a sample size of 341 would yield results with a reliability of plus or minus 5% at a 95% confidence level for a population size of 3,000. A sample size of 500 would improve the reliability to plus or minus 4%. In evaluation studies, sampling frames take into account practical as well as scientific considerations. The hospitals varied substantially in the number of physicians and residents on staff. The Rochester librarians agreed that it was important to have a reasonable number of respondents from each institution. Also, they did not want to overburden the librarians in the larger hospitals with extraordinary numbers of requests. Therefore, the sample included 10% of the active physicians in each urban hospital with more than 25 medical staff members and 30% in hospitals with 25 or fewer staff members. Because the use of the library by medical residents and the rural physicians was of particular interest, a 30% sample of this group was also taken. This approach resulted in a final sample size of 448, which consisted of 207 active physicians in Rochester, 156 residents, and 85 active physicians in the surrounding communities served by the circuit librarian program.

A systematic sample with a random start was drawn from each hospital's list of physicians and residents. If a physician who was systematically selected for the study declined to participate when telephoned, the research assistant attempted to determine a reason for the refusal and then continued with the sampling

**Table 1**  
Study population, sample, and usable returns

Hospitals*	Physicians			Residents			Total re- turns
	Pop.	Sample	Re- turns	Pop.	Sample	Re- turns	
Urban hospitals							
A	359	37	25	36	11	7	32
B	171	17	5	50	15	5	10
C	25	8	6	—	—	—	6
D	175	18	11	—	—	—	11
E	390	39	21	41	12	8	29
F	240	24	12	28	9	7	19
G	643	64	33	363	109	25	58
Total	2,003	207	113	518	156	52	165
Rural hospitals							
H	27	8	5	—	—	—	5
I	46	14	7	—	—	—	7
J	30	10	5	—	—	—	5
K	45	17	8	—	—	—	8
L	51	15	7	—	—	—	7
M	28	8	3	—	—	—	3
N	13	4	3	—	—	—	3
O	27	9	5	—	—	—	5
Total	267	85	43	—	—	—	43
Study total	2,270	292	156	518	156	52	208

\* Hospitals A to G were located in the urban Rochester area. Hospitals H to O were located in the surrounding five-county rural area served by a circuit librarian program. The sample was based on 10% of hospital-affiliated physicians in urban hospitals with more than 25 active physicians, and 30% of residents. In urban hospitals with 25 or fewer physicians and in the rural hospitals, a 30% sample was also taken. The total sample, including physicians and residents, was 448.

procedure until the required number of physicians was obtained for each hospital. A similar replacement procedure was followed if a physician could not be contacted by telephone after at least four attempts. Details of the population and sample are shown in Table 1.

**METHOD**

The Rochester group used the Chicago study instrument as a base for a questionnaire to measure the impact of information on clinical decision making. The Rochester group decided to focus specifically on the impact of library-supplied information on clinical decision making, rather than other measures, such as satisfaction with library service. In keeping with this decision, questions about the clinical value of the information were retained from the Chicago instrument. Because the Rochester study, like the Chicago study, included both library users and nonusers, a question about how often the physician had used the library in the last twelve months was also retained. To keep the questionnaire as brief as possible, Rochester physicians were asked only for the principal diagnosis of the patient, rather than for a description

of the question asked of the librarian, as was done in Chicago. Questions used in the Chicago study about the types of publications sought and received from the library and about satisfaction with various aspects of library service were omitted.

A question from the Chicago study about whether the information from the library enabled physicians to handle the clinical situation differently than they would have otherwise was considered to be of key importance, and a secondary question asking respondents to assess the importance of the change for the optimal care of their patients on a seven-point scale was added. Three new impact questions were created by the Rochester group. The first dealt with whether the information provided by the library changed some aspect of patient care or treatment: diagnosis; choice of tests, drugs, or other treatment; length of hospital stay; or the advice that the health professional gave to the patient. The second question asked whether the information contributed to the physician's ability to avoid events such as hospital admission, patient mortality, hospital-acquired infection, surgery, additional tests and procedures, or additional outpatient visits. The third question asked the physician to rate the importance of information received from different sources, including the library.

The research director circulated several drafts of the questionnaire to the Rochester librarians before the final version was agreed upon. A slightly modified version of the questionnaire was prepared for physicians who were served by the circuit librarian program. The questionnaire was pretested in Toronto, Ontario, Canada. The research director received ethical approval for the study from the University of Toronto.

The librarians in each hospital identified one or more senior medical staff members or administrators who agreed to be study facilitators. The facilitators' major role was to lend support to the study within their own institutions. In keeping with the earlier decision, the group hired a research assistant who was not connected with any of the participating libraries. The tasks of the research assistant in Rochester were to select the sample, to telephone the physicians to request their participation in the study, to prepare and mail the study packets to the participants, to send follow-up packets to nonrespondents approximately one month after the initial packets were mailed, and to telephone those who did not respond to the second mailing. The study packets contained a letter of support from the president of the Medical Society of the County of Monroe for Rochester physicians or from the Seventh District Branch of the Medical Society of the State of New York for physicians outside Rochester, an information sheet about the study that included the name and telephone number of the research director and a contact person at

**Table 2**  
Selected characteristics of participating hospitals' libraries\*

Hospital	Number of titles			CD-ROM	FTE staff		Annual budget
	Books	Journals	AV		Librarians†	Support staff	
A	4,000	250	401	Yes	1	1	103,000
B	5,000	200	25	No	1	1	83,000
C	921	186	0	No	1	0	51,000
D	1,500	140	1,310	No	.5	0	32,000
E	6,500	385	1,500	Yes	2	3	287,000
F	1,200	125	600	No	1	0	66,000
G	63,000	3,181	0	Yes	11	18	1,977,000

\* The rural hospitals used the facilities of Hospital E through a circuit librarian program.

† All librarians had M.L.S. degrees.

RRLC, one page of instructions for the study, the two-page evaluation questionnaire, a list of study facilitators in all the participating hospitals, and a stamped return envelope addressed to the research director. A second research assistant was hired in Toronto to assist in managing the returns and preparing the lists of nonrespondents for follow-up.

Initial telephone calls to physicians were made and study packets were mailed out over a two-month period, mid-September to mid-November 1990. Contacts and mailings were staggered, so that the librarians would not be overloaded with reference requests

at any one time. Follow-up activities were continued by the research assistant until mid-February. To further improve the response rate, the research director sent a letter and a list of nonrespondents to each study facilitator several weeks after the follow-up packets were mailed. The facilitator was asked to contact the nonrespondents personally and to emphasize the importance of each participant's questionnaire to the success of the study. A grant from MLA assisted researchers in these follow-up activities. The last questionnaires accepted for the study were received in March 1991.

Although the Rochester librarians were very involved in designing the study, recruiting the study facilitators, and obtaining the complete lists of physicians and residents for their hospitals, the librarians did not know which physicians were selected for the study. The physicians were asked not to reveal their involvement in the study to library staff. These precautions protected the anonymity and confidentiality of the responses and made it more likely that study requests would be treated by the library staff in the same manner as regular requests. Data about the participating libraries were gathered through the hospital library profile forms that each librarian completed during November 1990 (Tables 2-3).

The research director provided each librarian with a one-page fact sheet highlighting the overall results and the text of a ten-minute presentation with graphics that the librarians could use to report the results of the study. RRLC also sent a summary of the results

**Table 3**  
Selected statistics of participating libraries for November 1990\*

	Reference questions	Patient care questions	Mediated searches	Circulation	Pages photocopied	Interlibrary loans requested	Interlibrary loans supplied
Urban hospitals							
A	581	37	61	232	3,016	121	84
B	54	2	55	35	728	201	39
C	14	10	12	23	550	13	36
D	63	24	14	84	1,807	68	35
E	410	120	114	345	28,104	129	231
F	22	8	0	59	4,491	92	37
G	1,276	43	134	3,300	220,104	244	585
Rural hospitals†							
H	20	19	22	12	405	40	0
I	6	5	15	12	315	34	0
J	4	4	13	1	280	30	0
K	11	9	30	0	500	17	0
L	6	6	19	12	710	34	0
M	6	4	13	10	285	23	0
N	3	3	10	9	190	2	0
O	2	2	6	0	120	17	0

\* Each librarian was asked to record certain statistics during the month of November 1990, so that a general picture of the type and level of activity of the participating libraries could be reported.

† The rural hospitals had minimal on-site collections. Circulation and photocopy statistics represent items borrowed or copied from the host site for the circuit librarian program, Hospital E.

to each study facilitator. As agreed by the Rochester librarians at the beginning of the study, the research director sent all participating library directors confidential reports on the results for their own hospitals, together with a summary of the results for all of the libraries. Because the major importance of this study lies in the results for all the hospitals, the combined results are emphasized in this paper. In general, however, the results tended to be consistent among the different hospitals.

## RESULTS

As indicated earlier, the Rochester study involved fifteen hospitals and three physician groups: active physicians in Rochester, residents in Rochester, and physicians served by a circuit librarian program in the surrounding rural areas. Of the 448 physicians who agreed to participate in the study, more than half ( $n = 227$ ) returned the questionnaires. More than 63% ( $n = 144$ ) of these returns were received from the initial mailing, but 36.6% ( $n = 83$ ) were received as a result of follow-up activities. Of the 227 returns, 208 were usable. Most of the unusable questionnaires were returned blank or only partially completed by physicians who wrote that they did not have enough time to participate in the study. This overall response rate of 46.4% is slightly lower than the response rate by physicians in the Chicago study. Some nineteen different medical specialties were represented among the respondents. The most common were internal medicine (38.0%,  $n = 79$ ), surgery (8.7%,  $n = 18$ ), psychiatry (8.7%,  $n = 18$ ), and obstetrics and gynecology (7.7%,  $n = 16$ ). The participants had been in practice an average of sixteen years (SD 11.4). More than three fourths of the respondents were male (77.9%,  $n = 162$ ), and 22.1% ( $n = 46$ ) were female.

The response rates varied by hospital (Table 1); however, because the number of physicians eligible for the study in some of the hospitals was quite small, a more useful view can be obtained by comparing response rates within groups: for the Rochester physicians (54.6%,  $n = 113$ ), for the residents (33.3%,  $n = 52$ ), and for the rural physicians (50.6%,  $n = 43$ ). Comments on the returned questionnaires indicated that the lower response rate for the residents may have been due, in part, to the availability of end-user MEDLINE searching in three Rochester libraries. The residents had access to MEDLINE free of charge if they performed their own searches; in the largest library participating in the study, payment was required if the librarian was asked to do the search. The fact that nine physicians (4.3%) indicated that they completed their questionnaire after doing their own MEDLINE search is also evidence of the impact of end-user search service on the study. Of course, residents are also a

busy group within the hospital, with heavy patient care responsibilities.

In the Rochester study, the research assistant recorded the number of physicians who declined to participate in the study when contacted by telephone or who could not be contacted in four attempts. Ninety-three physicians declined to participate at this stage or could not be contacted; these included fifty-two active physicians in Rochester, two residents, and thirty-nine rural physicians. The three major reasons given for not participating were that the physicians did not have enough time ( $n = 12$ ); that they did not answer surveys or were not interested in the study ( $n = 15$ ); or that they did not use the library ( $n = 56$ ). If the latter reason was given, the research assistant explained to the physician that the study was designed to include both library users and nonusers; however, the majority of these physicians still declined to participate. An average of three telephone calls was required to obtain each physician's agreement to participate. More than 1,600 calls were made by the research assistant to obtain the sample of 448 participating physicians.

More than 70% ( $n = 147$ ) of the respondents had used the library at least once a month during the previous twelve months, and there were significant differences in the frequency of use reported by the different groups in the study. The residents tended to be the most frequent library users. The results suggest that there were more frequent library users participating in the Rochester study than might be expected in the general physician population; but this was true also in the Chicago study, where 86.6% ( $n = 65$ ) of the physicians reported using the library at least once a month during the previous twelve months (Table 4).

The principal diagnoses reported by the physicians were classified according to the broad disease categories in the *Medical Subject Headings Tree Structures*. Twenty-three categories were identified. The most common questions by far were about neoplasms (24.0%,  $n = 50$ ), followed by cardiovascular diseases (9.6%,  $n = 20$ ) and mental disorders (5.3%,  $n = 11$ ). The variety of diagnoses and clinical situations was notable. Diagnoses could not be identified by the researchers for 12.5% ( $n = 26$ ) of the questionnaires.

Physicians were asked to characterize the clinical value of the information, as in the Chicago study; similar results were achieved (Table 5). The Rochester study also asked whether the information provided by the library saved the physician time, and 84.7% ( $n = 166$  of 196 responding) agreed that this was the case. As a result of the information received from the library, 80% ( $n = 98$ ) of the physicians indicated that they probably (48.0%) or definitely (32.4%) handled some aspect of the clinical situation differently than they would have handled it otherwise. In the Roch-

**Table 4**  
Frequency of library use by physicians (percentage)\*

Frequency of use	Rochester study				Chicago study
	Urban physicians (n = 113)	Residents (n = 52)	Rural physicians (n = 43)	All physicians (n = 208)	All physicians (n = 75)
Once a week or more often	28.3 (32)	50.0 (26)	9.3 (4)	29.8 (62)	57.3 (43)
At least once a month, but not weekly	44.2 (50)	32.7 (17)	41.9 (18)	40.9 (85)	29.3 (22)
At least once during the year, but not monthly	26.5 (30)	17.3 (9)	46.5 (20)	28.4 (59)	12.0 (9)
Not at all in the last 12 months	.9 (1)	0.0 (0)	2.3 (1)	1.0 (2)	1.3 (1)

\* The number of respondents for each question is shown in parentheses.

ester study, the mean importance of the change for the optimal care of the patients involved was measured on a one- to seven-point scale (1 = unimportant; 7 = important). The mean value reported for the importance of the change was 5.4 (SD .99), which indicates that the physicians considered the changes to be of considerable importance.

A major contribution of the Rochester study was to pinpoint specific areas of patient care in which the information from the library made a difference. A comparative summary of the changes reported by urban physicians, residents, and rural physicians is shown in Table 6. For this analysis, all "no," "not applicable," and missing values were coded as "no." The most common change reported by the physicians was a change in the advice given to the patient (71.6%, n = 149), followed by a change in treatment (59.6%, n = 124), a change in diagnostic tests (50.5%, n = 105), a change in drugs (45.2%, n = 94), and a change in posthospital care or treatment (38.5%, n = 80). Almost 30% of the physicians reported that the information changed their diagnosis (29.3%, n = 61), and almost 20% said it shortened the patient's hospital stay (19.2%, n = 40).

The Rochester group thought that it was important in the current health care environment to measure not only changes in patient care decisions, but also whether the information from the library contributed to the physician's ability to avoid adverse events in patients (Table 7). The most frequently avoided event was additional tests or procedures (49.0%, n = 102), followed by additional outpatient visits (26.4%, n = 55), surgery (21.2%, n = 44), patient mortality (19.2%, n = 40), hospital admission (11.5%, n = 24), and hospital-acquired infection (8.2%, n = 17). For this analysis as well, all "no," "not applicable," and missing values were coded as "no." While the results for urban, resident, and rural physicians all showed that information from the library had a substantial impact on patient care, the residents were the most likely to report they they had handled some aspect of patient care differently, changed a diagnosis or avoided additional tests and procedures.

Earlier studies of clinical librarian programs by Scura and Davidoff [17] and Marshall and Neufeld [18] suggested that clinically related information provided by the library could be as valuable to physicians as information from other sources, such as diagnostic imaging, lab tests, and colleagues. The Rochester librarians were also aware that the library was likely to be only one of several information sources that physicians would use in a given clinical situation. To explore this matter, physicians were asked to rate the importance of the information received from different sources on a seven-point scale (1 = unimportant; 7 = important) (Table 8).

The mean number of information sources reported by the physicians was 3.5 (SD 1.3). The library received the highest mean rating of all the sources (5.4, SD 1.2, n = 201), followed by discussion with colleagues (5.2, SD 1.3, n = 181) and diagnostic imaging (5.2, SD 1.7, n = 140). Lab tests were used by 164 respondents and had a mean rating of 4.9 (SD 1.6).

**Table 5**  
Assessments of clinical value of information by physicians (percentage)\*

Assessment criteria	Rochester study	Chicago study
1. Quality		
Relevant	90.7 (175)	88.4 (61)
Accurate and current	100.0 (191)	98.6 (69)
2. Cognitive value		
Refreshed memory of detail or facts	94.5 (190)	94.4 (68)
Substantiated prior knowledge or belief	79.5 (151)	82.9 (58)
Provided new knowledge	93.1 (189)	95.9 (70)
3. Contribution to quality patient care		
Information was of clinical value	96.9 (188)	98.6 (68)
Better informed clinical decisions	96.5 (194)	98.6 (72)
Contributed to higher quality care	94.1 (192)	94.6 (70)
4. Saved the physician time	84.7 (166)	Not asked

\* Not every participant responded to every question. Percentages are based on responses to each individual item. Numbers of physicians responding positively are shown in parentheses.

**Table 6**  
Changes in patient care reported by physicians (percentage)\*

Changes reported	Urban physicians (n = 113)	Residents (n = 52)	Rural physicians (n = 43)	All (n = 208)	X <sup>2</sup>	df	P
Handled situation differently	71.7	88.5	86.0	80.4	7.70	2	.02†
Diagnosis	31.0	38.5	14.0	29.3	7.14	2	.02†
Choice of tests	44.2	59.6	55.8	50.5	3.98	2	.14
Choice of drugs	45.1	42.3	48.8	45.2	.40	2	.82
Choice of other treatment	54.0	65.4	67.4	59.6	3.30	2	.19
Length of stay (reduce)	16.8	25.0	18.6	19.2	1.55	2	.46
Posthospital care or treatment	42.5	38.5	27.9	38.5	2.79	2	.25
Changed advice given to patient	73.5	73.1	65.1	71.6	1.13	2	.57

\* The percentage represents the proportion of physicians who answered "yes" to the items. All "no," "not applicable," and missing values were coded as "no."  
† Results statistically significant at the 0.05 level or better.

Sixteen physicians reported using some other type of information source in addition to those listed on the questionnaire. Readers should interpret these results with some caution, keeping in mind that the physicians were responding on the basis of a single clinical case for which they had specifically sought information from the library. Presumably, the library was judged by the physician as an appropriate source for this information; other sources of information, such as lab tests or diagnostic imaging or colleagues, may have been less useful in the particular circumstance.

Readers should also note that the physicians' requests in the Rochester study are unlikely to be representative of all information requests filled by hospital libraries. In the study, physicians were asked to select a clinical situation for which further information might be useful. Not all requests to the library are for clinically related information. Many deal with research, education, and management issues. Also, there are undoubtedly many other situations in which physicians and other health professionals use information from the hospital library that has more subtle and long-term impacts. Even with these cautions, the

study provides a positive picture of the ability of hospital libraries to respond effectively to information requests in key clinical situations. For these types of clinical questions, the study showed that small hospital libraries and circuit librarian programs, supported by strong interlibrary cooperation and resource sharing, can also respond effectively.

## DISCUSSION

The study confirmed the finding of the Chicago study that information provided by hospital libraries is perceived by physicians as having a significant impact on clinical decision making. More importantly, the Rochester study adds to our store of scientific knowledge about the nature and extent of the hospital library's impact in several ways:

- by measuring the importance of changes in clinical care that resulted from the application of the information provided by the library;
- by pinpointing the specific aspects of clinical care that were affected by the information provided by the library;

**Table 7**  
Avoidance of adverse events reported by physicians (percentage)\*

Adverse event avoided	Urban physicians (n = 113)	Residents (n = 52)	Rural physicians (n = 43)	All (n = 208)	X <sup>2</sup>	df	P
Hospital admission	12.4	7.7	14.0	11.5	1.08	2	.58
Patient mortality	16.8	28.8	14.0	19.2	4.29	2	.12
Hospital-acquired infection	5.3	15.4	7.0	8.2	4.92	2	.09
Surgery	18.6	30.8	16.3	21.2	3.94	2	.14
Additional tests or procedures	45.1	67.3	37.2	49.0	10.04	2	.00†
Additional outpatient visits	28.3	25.0	23.3	26.4	.48	2	.78

\* The percentage represents the proportion of physicians who answered "yes" to the items. All "no," "not applicable," and missing values were coded as "no."  
† Result statistically significant at the 0.05 level or better.



- by identifying situations in which the information provided by the library contributed to the avoidance of specific adverse events for patients; and
- by establishing the relative value of the information provided by the hospital library in comparison with other sources of clinical decision-making data, such as diagnostic imaging, lab tests, and discussions with colleagues.

The fact that all the hospitals in Rochester and the surrounding five-county area participated in the study also adds to the scientific validity of the findings.

Readers will find it useful to note the similarity between the events that Rochester physicians said they were able to avoid with the assistance of information provided by the hospital library and the adverse events identified in the Harvard medical practice study [19]. The authors of the Harvard study, which is also based on data from New York State, point out that a high proportion of adverse events are due to patient-management errors, rather than unavailability of medical information, and are thus preventable. The experiences reported by physicians in the Rochester study suggest that information provided by hospital libraries not only makes a positive contribution to patient care at present, but that the increased use of such information could help to reduce the frequency and severity of adverse events in hospitalized patients in the future.

Despite the extensive efforts to ensure scientific validity in the Rochester study, including efforts to maximize the response rate, the percentage of usable returns was still only 46.4% ( $n = 208$ ), slightly lower than the physician response rate in the Chicago study. This experience, and the experience of other groups that have tried to replicate the Chicago study, suggests that, for this type of study, a higher response rate may not be possible. Physicians are an extremely busy group of professionals, and we were asking them not only to answer a brief questionnaire, but also to contact the hospital library, make a request, read the materials, and evaluate the effect of the information contained in the materials on the care of their patient. The physicians who did respond indicated that information provided by hospital libraries had a substantial impact on their clinical decisions and on the subsequent care of patients. Even if all of the non-respondents never made use of the hospital library in their clinical decision making, the results of the study would still be impressive.

Several other potential limitations of the study should be acknowledged. Although the Rochester area hospital librarians did not know which physicians were participating in the study, they were aware that the study was taking place over a period of several months. A letter of support from the medical society president, which was included in the packet of materials sent to participating physicians, stated that the

**Table 8**  
Importance of information sources\*

Information source†	Urban physicians	Residents	Rural physicians	All
Library	5.3 (108) SD 1.3	5.4 (51) SD 1.1	5.7 (42) SD 1.3	5.4 (201) SD 1.2
Diagnostic imaging	5.1 (76) SD 1.7	5.4 (41) SD 1.5	5.0 (23) SD 2.1	5.2 (140) SD 1.7
Lab tests	4.7 (92) SD 1.6	4.9 (43) SD 1.5	5.3 (29) SD 1.6	4.9 (164) SD 1.6
Discussion with colleagues	5.0 (96) SD 1.33	5.7 (49) SD 1.0	5.1 (36) SD 1.6	5.2 (181) SD 1.3

\* Respondents were asked to rate the importance of the information received from different sources in relation to the particular medical situation on a 7-point scale, where 1 = unimportant and 7 = important.

† Not all respondents used the various information sources. Numbers of respondents who rated each source are shown in parentheses.

study examined a research question of great importance to physicians in New York State, briefly described the regulatory situation, and indicated that the results could have implications for medical library service. While the letter may have encouraged positive responses from physicians who wanted to show support for the library, it is also possible that the letter had the intended effect of increasing the overall response rate, thus adding to the validity of the study.

Another limitation of both the Chicago and Rochester studies is that the results are based on self-reporting. While physicians, as key decision makers in the health care system, are in the best position to evaluate the impact of library information on their own clinical decisions, it would be desirable to have confirming data from other sources. The Rochester study provides additional data about where the library's impact on patient care is likely to occur, and other researchers may be able to use these results to design studies that will collect additional kinds of objective data.

A final limitation is one that is present in all quantitative studies: to ask for yes or no answers in situations that involve complex human judgment and decision making is a blunt measurement technique at best. The current need for hard data with which to evaluate the contribution of the library makes this type of measurement necessary; however, such studies should be considered only the beginning of more sophisticated and sensitive approaches to understanding the library's part in the mosaic of information sources and processes health professionals use to arrive at clinical decisions. The Rochester librarians recognized that qualitative data would assist them in interpreting the numeric results. For this purpose, members of the Upstate New York and Ontario Chap-

ter of MLA were asked to approach physicians who might be willing to provide information case studies. The descriptions received were appended to the final project report. The idea for these case studies came from a physician's letter to the editor of the *New York State Journal of Medicine* that described six clinical cases in which information provided by the library had benefited patient care [20]. The physicians' written comments on the questionnaires were also appended to the final report, which is available from RRLC [21]. Together, these appendixes provide a more in-depth picture of the type of clinical information sought by physicians and the type of information provided by the library. A number of the physicians' comments also indicated the high regard in which the hospital libraries were held. As one physician wrote,

I believe that library service is an integral part of the hospital and an absolutely essential service. I would not want to practice in a hospital without a library, nor would I like to be a patient in one.

#### ACKNOWLEDGMENTS

The study was made possible through the cooperation of the participating physicians. The study facilitators and library directors in the urban Rochester area were Michael M. Finigan, M.D., and Sally Gerling, The Genesee Hospital; Rich Abbott, M.D., and Diane Robbins, Highland Hospital; Roger Oskvig, M.D., and Elinor Reynolds, Monroe Community Hospital; Bill D. Stout, M.D., and Kathy Martin, Park Ridge Hospital; Robert C. Dale, M.D., Thomas H. Casey, M.D., and Bernie Todd Smith, Rochester General Hospital; Joseph S. Salipante, M.D., and Mary Daniel, St. Mary's Hospital; Robert J. Joynt, M.D., and Lucretia McClure, University of Rochester School of Medicine and Dentistry; and Rudolph J. Napodano, M.D., Primary Care Program in Internal Medicine. Facilitators for the rural hospitals were Jack Resnik, M.D., Clifton Springs Hospital and Clinic; Karl J. Marchenese, M.D., F. F. Thompson Hospital; Mark Ryan, M.D., Geneva General Hospital; Wheelock Southgate, M.D., Lakeside Memorial Hospital; John Ghertner, M.D., Myers Community Hospital; Barbara Witt, Newark-Wayne Community Hospital; Thomas J. Dwyer, M.D., Noyes Memorial Hospital; and Mridu Agarwal, M.D., Wyoming County Community Hospital. Circuit librarians: Tami Hartzell and Lana Rudi. David N. King was a consultant to the study. Special thanks to Kathleen Miller, Rochester Regional Library Council; Bernie Todd Smith, Rochester General Hospital; June Glaser, Eastman Dental Center; and research assistants, Susan Garrison and Leah Hollenberg.

#### REFERENCES

1. Medicare and Medicaid programs: conditions of participation for hospitals. *Fed Regist* 51(116):22033-4, 1986.
2. PHILIPS DH, JR. (New York State Department of Health). Letter to Jane Allen, president, Upstate New York and Ontario Chapter of the Medical Library Association. March 20, 1989.

3. PHILIPS DH, JR. (New York State Department of Health). Letter to Ursula H. Poland, Hospital Library Services Task Force. January 1, 1991.
4. Manual for assessing the quality of health sciences libraries in hospitals. Albany: The University of the State of New York, 1983.
5. Standards for Canadian health care facility libraries; qualitative and quantitative guidelines for assessment, 1989. Toronto: Canadian Health Libraries Association, 1989.
6. McCLURE CR, REIFSNYDER B. Performance measures for corporate information centers. *Spec Libr* 1984;75:193-204.
7. MATARAZZO JM ET AL. President's Task Force on the Value of the Information Professional. Washington, D.C.: Special Libraries Association, 1987.
8. HARDY MC, YEOH JW, CRAWFORD S. Evaluating the impact of library services on the quality and cost of medical care. *Bull Med Libr Assoc* 1985;73(1):43-6.
9. BARBOUR GL, YOUNG MN. Morning report. Role of the clinical librarian. *JAMA* 1986;255(14):1921-2.
10. CIMPL K. Clinical medical librarianship: a review of the literature. *Bull Med Libr Assoc* 1985;73(1):21-8.
11. HALSTED DD, WARD DH, NEELEY DM. The evolving role of clinical medical librarians. *Bull Med Libr Assoc* 1989;77(3):299-301.
12. MANNING PR, CLINTWORTH WA, SINOPOLI LM, TAYLOR JP ET AL. A method of self-directed learning in continuing medical education with implications for recertification. *Ann Intern Med* 1987;107:909-13.
13. MANNING PR, LEE PV, CLINTWORTH WA, DENSON TA ET AL. Changing prescribing practices through individual education. *JAMA* 1986;256(2):230-2.
14. MANNING PR, LEE PV, DENSON TA, GILMAN NJ. Determining educational needs in the physician's office. *JAMA* 1980;244(10):1112-5.
15. WILSON SR, STARR-SCHNEIDKRAUT N, COOPER MD. Use of the critical incident technique to evaluate the impact of MEDLINE. Palo Alto, CA: American Institutes of Research, 1989.
16. KING DN. The contribution of hospital library services to patient care. *Bull Med Libr Assoc* 1987;75(4):291-301.
17. SCURA G, DAVIDOFF F. Case-related use of the medical literature; clinical librarian service for improving patient care. *JAMA* 1981 Jan 2;245:50-2.
18. MARSHALL JG, NEUFELD VR. A randomized trial of librarian education participation in clinical settings. *J Med Educ* 1981;56(5):409-16.
19. LEAPE LL, BRENNAN TA, LAIRD N ET AL. The nature of adverse events in hospitalized patients—results of the Harvard medical practice study II. *N Eng J Med* 1991;324:377-84.
20. BURKE L. Letter to the editor. *NY State J Med* 1990;90(8):420-21.
21. MARSHALL JG. The impact of information provided by hospital libraries in the Rochester area on clinical decision making. Final report. Rochester, NY: Rochester Regional Library Council, 1991. (Available from Rochester Regional Library Council, 302 N. Goodman St., Rochester, NY 14607.)

Received August 1991; accepted October 1991