
Comparing and using assessments of the value of information to clinical decision-making*†

By Christine J. Urquhart, M.Sc., MIIInfSc
Lecturer

John B. Hepworth, M.A., MIIInfSc, F.L.A.
Senior Lecturer

Health Information Management Team
Department of Information and Library Studies
University of Wales Aberystwyth
Llanbadarn Campus
Aberystwyth Dyfed
SY23 3AS United Kingdom

This paper discusses the Value project, which assessed the value to clinical decision-making of information supplied by National Health Service (NHS) library and information services. The project not only showed how health libraries in the United Kingdom help clinicians in decision-making but also provided quality assurance guidelines for these libraries to help make their information services more effective. The paper reviews methods and results used in previous studies of the value of health libraries, noting that methodological differences appear to affect the results. The paper also discusses aspects of user involvement, categories of clinical decision-making, the value of information to present and future clinical decisions, and the combination of quantitative and qualitative assessments of value, as applied to the Value project and the studies reviewed. The Value project also demonstrated that the value placed on information depends in part on the career stage of the physician. The paper outlines the structure of the quality assurance tool kit, which is based on the findings and methods used in the Value project.

INTRODUCTION

All health care services increasingly have to provide evidence of their effectiveness. For the manager of a health library, the evidence of effectiveness must be related to patient care outcomes. The information services outcomes that are easiest to assess may be those related to immediate patient care, but the effects of information on future clinical decisions should not

be neglected. Information may help resolve a current clinical problem but the information may also add to a health care professional's medical knowledge and hence contribute to future clinical decisions. This paper describes a project that evaluated the impact of medical library services in the United Kingdom (U.K.).

LITERATURE REVIEW

Quantitative assessments of value

In a study of eight hospital library services in the Chicago area, health professionals were asked to select a current case or clinical situation for which further information might be useful and to request information from the hospital library [1]. The questionnaire used in the Chicago study was the basis for the larger Rochester study in New York [2-3]. The Rochester study was restricted to physicians. The results were similar to those of the Chicago study, with more

* This research was supported by the British Library Research and Development Department and by a group of Postgraduate Medical Deans (November 1993-April 1995).

† The full research report is available as "The value to clinical decision-making of information supplied by NHS library and information services," Report no. 6205, from British Library Document Supply Centre (British Thesis Service) Boston Spa, Wetherby, West Yorkshire LS23 7BQ, U.K. Price: 11.00 pounds sterling.

than 95% of responding physicians agreeing that the information provided had clinical value and contributed to better-informed clinical decisions and increased quality of care.

Similar, though less dramatic, results were obtained in a quality assurance study of the entire clinical staff at a Kentucky hospital, where 88% of the responding physicians agreed that the information received from the library had clinical value [4]. The overall response rate was 26%, lower than that obtained in the Rochester study (46%) or the Chicago study (50%). A study at five Spanish university hospitals found that 87% of the responding physicians (response rate 20%) agreed that the information provided by the library was useful for clinical decision-making [5].

For health library and information services, these results are promising, but several caveats need to be considered. While it is not surprising that regular library users are more likely to respond and offer a positive assessment, the relatively low response rates (20% to 50%) suggest that more qualitative information will be necessary to validate any judgment about the effectiveness of the information and the library service in supporting clinical decision-making. Some of the problems involved in relating costs to benefits are evident in a study of the effect of online literature-searching on length of stay and patient care costs [6]. Online literature-searching in fact was associated with increased costs, as the physicians appeared to seek information only for the nonroutine, more severe cases. The study demonstrated that costs would be minimized if the search were conducted early in the hospital in-patient period.

Qualitative assessments of value

Comments on the Rochester questionnaires and case studies appended to the final report [7] provide some qualitative evidence of the ways in which information is used by physicians. In 1988 the National Library of Medicine (NLM) initiated a "critical incident" study of situations in which physicians turned to MEDLINE for assistance [8]. Telephone interviews were conducted with MEDLINE users, and respondents were asked to describe recent searches they had conducted, or had asked others to conduct for them, that were particularly effective or ineffective in meeting a specific information need. Of the 1,158 searches studied, 476 were concerned particularly with patient care, and the main impacts on clinical problem-solving were related to the choice of therapy and the recognition and diagnosis of a medical problem or condition [9]. In a few cases the impact on outcomes was dramatic in saving or prolonging the patient's life, but in the majority of cases the information contributed more to the quality of care.

VALUE TO CLINICAL DECISION-MAKING – A U.K. APPROACH

The Value project examined the value to postgraduate and continuing medical education of information supplied by National Health Service (NHS) library and information services in the U.K. The objectives were to establish the value of information in terms of benefits to clinical decision-making, and to examine the factors affecting information delivery. One of the deliverables of the project was a quality assurance tool kit for auditing information services. The research may be extended to other health professional groups.

Methods

The Value project methods were based as much as possible on previous studies, with emphasis placed on obtaining the views of physicians who rarely used the information service. The Value project examined the value of information to physicians through follow-up surveys of those who had made requests or searches. These value judgments were placed in context with information gathered in a critical incident survey of patterns of information needs and use among a random sample of physicians. The two sets of surveys were complementary. Follow-up interviews provided case study evidence for particular incidents where information was found to be of actual or potential value. Interviews also revealed in detail the perceptions and attitudes toward seeking information that could only be suggested in the questionnaire responses.

For the critical-incident study a questionnaire was sent once a week, for four weeks, to approximately 300 clinicians (hospital and community staff, including general practitioners). They were asked to check categories indicating, for one incident in that week, why information was needed, which sources had been consulted, and how successful the request for information had been. The categories covered aspects of patient care, education, and research. The questionnaire was followed up by selected interviews designed to discover more about patient care incidents or aspects of information-seeking. As the sample was random, both users and nonusers of the library and information service were included, and the eleven sites included a cross section of library types (teaching hospital, district general hospitals, specialist hospital) and geographical areas (urban, rural, and small town).

For the survey of the value of information obtained from searches or requests, clinicians at the same eleven sites were asked to assess the value to present and future clinical decision-making of information obtained from the following:

- requests for loans or copies of material not held locally (interlibrary loan [ILL] requests)
- mediated searches (searches made by information service staff on behalf of the clinician)
- MEDLINE searches conducted by the clinicians themselves (end-user searches in the library)

Also considered were the results of a complementary study of MEDLINE searches conducted by British Medical Association Dial-up MEDLINE users [10].

The interviews complemented the surveys by providing case studies of the clinical decisions that might be—or were—affected; details about information needs and uses among various staff groups (junior doctors in the training grades, non-consultant career grade staff; and consultants such as specialist physicians or surgeons); and information about the searching expectations and techniques of end users of MEDLINE on CD-ROM.

Clinicians approached for the critical incident survey were eliminated from the sample pool for the survey of searches and requests. For the latter, clinicians were approached more than once only if they had not responded to a first questionnaire and the second request or search was for an identifiably different incident.

Although the Value project was similar to the Rochester [11–12] and Chicago [13] studies in asking clinicians about the value of information to clinical decision-making, no attempt was made to elicit information requests from clinicians. “Planted” requests of this type may provide unrealistic or unrepresentative outcomes. In any event, with so many searches now done by clinicians themselves through MEDLINE on CD-ROM or dial-up services, the complete pattern of information-seeking and use should be studied to make sense of the contribution of the library and information services to clinical decision-making. Both actual requests for searches and searches conducted by end users must be covered.

Opinion leader interviews and pilot study results suggested that the questions used to determine effects on clinical decision-making in the United States would need to be altered for the U.K. context. In the Rochester study the question posed was, “Did the information provided by the library change (or will it change) . . .” various categories of clinical decision-making (e.g., diagnosis, choice of tests, choice of drugs). Respondents could check Yes, No, or Not Applicable. The results of pilot work for the Value project suggested that many U.K. clinicians would be unwilling to provide categorical answers. It is possible that some respondents in the Rochester study answered affirmatively when “maybe” would have been a more accurate response.

Accordingly, the question posed in the Value project was, “How might the information provided contribute to your future clinical decisions?” Respon-

dents were asked to consider whether “it may help—or did help” with various categories of clinical decisions. This is more tentative than the question posed in the Rochester study, but the Value project included searches and requests with all possible purposes, including education, research, and patient care, not simply clinical care purposes as in the Rochester study.

The categories of clinical decision-making that emerged from the NLM study of MEDLINE [14] served as the basis for the categories of clinical decision-making used in the Value project. In the follow-up interviews in the Value project, procedures similar to those of the NLM study were used, with each interview focusing on one major category. For the survey, Value project respondents were permitted to check more than one category, as pilot studies had indicated that information might affect more than one type of clinical decision-making.

Response rates

The response rate for the critical incident survey of the patterns of information need and use was 46% (519 of 1,133 questionnaires returned). The individual response rate was 69% (196 of the 286 respondents replied at least once). Three or more questionnaires were returned by 39% of the sample. Site response rates ranged from 43% to 77%, with the lowest rate due largely to lack of response from the general practitioners at that site. Efforts were made to focus on the low-response groups in follow-up interviews.

For the survey of searches and requests, the overall response rate was 68% (486 of 713 clinicians) for the library searches and requests and 60% (60 of 100 clinicians) for the Dial-up MEDLINE group (see Table 1).

RESULTS

The Value project was concerned principally with the value of information for clinical decision-making, but the scope of the project was broader than that of previous studies on this topic. The accompanying study

Table 1
Value project: response for different types of request and search

Type of request or search	Number of responses	Number in original sample	Percentage response
End user	227	337	67%
Interlibrary loan	212	307	69%
Mediated	47	81	58%
Total (library requests and searches)	486	725 (713 actually traceable)	68%
Dial-up MEDLINE	60	100	60%

Table 2
Comparison of immediate impact assessments

Assessment criteria	Chicago study	Rochester study	Spanish study	Value project
Refreshed memory of details or facts	94%	95%	72%	57%
Substantiated prior knowledge or belief	83%	80%	41%	66%
Provided new knowledge	96%	93%	not available	88%
Notes: based on the response to the individual question	No. respondents varied from	No. respondents varied from	Based on 799 returns	No. respondents varied from 438 to 457
Comparable data not available for NLM study	58 to 70	151 to 190		

of information needs and use provided insights into the factors affecting value assessment. Case study interviews not only provided a check of the decision-making categories used but also illuminated how the information was or would be used to help make clinical decisions. Supporting studies of actual use of the library and information services by various staff groups provided additional data for a tool kit, which library and information services can use to audit their services. The quality assurance tool kit was intended to foster a shift in emphasis from the present value of the information service to evaluation of value added in the future.

Immediate impact of information

The majority of library users were very satisfied with the results of their request or search. For most (88%), new information was provided, while 66% agreed that the information substantiated what they knew or suspected. About 73% of users could use some of the information immediately.

The purposes of searches and requests were varied. Although patient care was a reason for 43% of the library searches and requests, patient care purposes were the sole focus in only 13%. Educational and research purposes predominated, with 32% of library searches and requests made solely to support research and publication, and educational reasons cited for 48% for searches and requests, reflecting the need to update knowledge. As might be expected from a pattern dominated by education and research, the search for information tended to be ongoing, with most users (71%) indicating that more information on the topic would be required.

Table 2 compares the results of four studies, including the Value project, regarding immediate impact on cognitive knowledge. The situations in which these questions were asked varied, which accounts for some of the differences in results. Both the Rochester [15-16] and Chicago [17] studies were based on

mediated requests solicited from physicians for a particular clinical problem. The Spanish study [18] asked for the general views of physicians on the value of the library services to clinical decision-making. The Value project examined specific requests and searches made over a two-month period, usually those initiated by the physicians themselves. Therefore, it is to be expected that the mediated searches (Rochester and Chicago) would obtain information already known or suspected by the physicians, but that physicians would be less likely (Value project) to go looking personally for such information.

Contribution to future clinical decision-making

The Value results also demonstrated that clinicians regard information obtained in searching to be of *future* use in clinical decision-making. The information may have been required originally for purposes other than direct patient care, but that information would also be useful, or indeed was useful, as a basis for better-informed decisions about patient care. Table 3 shows which categories of decision-making were most affected. Overall, physicians said the information provided would contribute most to improved understanding of a patient's condition ("recognition of an abnormal or normal condition"), more-informed choice of appropriate therapy ("identification or evaluation of alternative therapies"), and increased recognition of the implications of that therapy for the patient and family ("improved quality of life for patient and/or family").

The breadth of clinical decision-making categories that may be affected is also notable, reflecting the many factors that have to be considered in patient care. The average number of categories of decision-making that might be affected was slightly more than three per clinician (total frequency count 1,594, number of respondents 486). The same information is useful to different individuals in different ways and to a different extent.

Table 3
Impact of information on clinical decision-making (library group)

The information would (or did) help in . . .	Frequency of mention (percentage of response) N = 486*
one or more category of clinical decision-making	79%
recognition of abnormal or normal condition	36%
identification/evaluation of alternative therapies	35%
improved quality of life for patient and/or family	33%
confirmation of proposed therapy	32%
differential diagnosis	31%
minimization of risks of treatment	27%
audit or standards of care	26%
revision of treatment plan	25%
choice of diagnostic test	22%
legal or ethical issues	16%
89% (321/361) of clinicians indicated that at least one category of clinical decision-making would be affected. 125 respondents were in clinically related posts but had no direct patient care responsibilities.	

* Total number of responses = 486 (of which 361 were clinicians). % response is calculated on the response for the category.

The number of clinical decisions that may be affected for an individual does serve as a crude indicator of the overall utility of the information for that individual. It is interesting that the information appeared to be of greatest use to the most junior registered doctors, the senior house officers (SHOs), and the Dial-up MEDLINE users (predominantly consultants). The SHOs might be expected to benefit most from information, as their clinical experience is limited and their learning needs are quite broad. The Dial-up MEDLINE group may be more active information seekers than are clinicians in general, and the convenience of MEDLINE searching may encourage more speculative searches for patient-care-related purposes than otherwise would be conducted.

Vignettes of groups of clinicians

One aspect of searching studied in more detail in the Value project than in other, similar studies was the benefit of information use, and the barriers to that use, for particular groups of medical staff. Detailed analysis revealed the different priorities of junior doctors and their more senior colleagues. The junior doctor respondents in the Value project required information that would assist in basic patient care. For SHOs, information that enhanced existing understanding of a condition and its treatment was highly valued. This finding parallels the results of a comparison of faculty and house staff perceptions of the

purposes and type of medical reference information required quickly. That study found that medical house staff were more likely to require information for patient management and diagnostic work-ups than faculty [19].

Of all groups of hospital staff in the Value project, registrars (junior hospital doctors who have completed the first stage of specialist training) were most likely to require information for patient education, as reflected in the top rating given by registrars to "quality of life" aspects of clinical decision-making. The pattern for consultants is more diverse, as expected. Their need to evaluate proposed changes in patient care management, found in the critical incident survey, was reflected in the high priority given to audit and evaluation of therapies in the survey of searches and requests.

The following extracts from interviews illustrate how information was used in the various categories of clinical decision-making and the value placed on the information:

- choice of diagnostic test: "trying to find a definitive suicide risk scale . . . this is the most useful [information] so far . . . would be useful for ensuring patients get appropriate treatment and avoid unnecessary mortality" (senior registrar, ILL request).
- recognition of a normal or abnormal condition: "had a patient whose brother had suffered from the same [condition] . . . checking up on hereditary aspects of this condition . . . thought of publishing but search revealed we had not discovered anything new" (SHO, ILL request).
- differential diagnosis: "suspected that it was impossible to tell difference between benign and malignant tumour of this type on [magnetic resonance image] scan . . . article confirmed this . . . then possible to state that a biopsy was necessary in this case" (senior registrar, ILL request).
- confirmation of proposed therapy: "Papers showed that there was a reasonable prognosis if secondary nodes were excised . . . could therefore proceed fairly confidently with surgery and patient could be reassured about prognosis" (senior registrar, mediated search).
- identification and evaluation of alternative therapies: "paper did evaluate administration method . . . comparing intermittent high dose with low dose given daily . . . drug highly toxic . . . would be useful to know about this in future for evaluation of treatment" (SHO, ILL request).
- minimization of risks of treatment: "complications of varicose vein surgery . . . to improve such surgery" (Dial-up MEDLINE user).
- revision of treatment plan: "will probably now change medication advice given to pregnant asthmatic patients" (registrar, end-user search).
- audit or standards of care: "audit of alcoholism ser-

Table 4
Rank order comparison of clinical decision-making results in three studies

Rochester study category	%	Value project category	%	Value project interviews only (no. in group)	%	NLM study category (no. in group)	%
Advice to patient	72%	Recognition of abnormal or normal condition	36%	Development of an appropriate treatment plan (32)	53%	Development of an appropriate treatment plan (216)	45%
Choice of other treatment	60%	Identification or evaluation of different therapies	35%	Recognition and proper diagnosis of a medical problem or condition (17)	27%	Recognition and proper diagnosis of a medical problem or condition (104)	22%
Choice of tests	51%	Improved quality of life for patient and/or family	33%	Quality of life for patient and/or family (6)	10%	Maintained an effective physician/patient relationship (46)	10%
Choice of drugs	45%	Confirmation of proposed therapy	32%	Audit (3)	5%	Implemented treatment plan (67)	14%
Diagnosis	29%	Differential diagnosis	31%	Legal or ethical issues (3)	5%	Used the most appropriate test (34)	7%
		Minimization of risks of treatment	27%			Other (9)	2%
No. responses = 208		No. responses = 486		No. interviews = 61		No. case studies = 476	

Note: Comparable data not available for Spanish study.

vices ... looking at treatment being delivered ... initial stages ... looking at internal audit of what is happening here ... and outcomes ... and comparing this with practice elsewhere" (consultant, ILL request).

■ improved quality of life for patient or family: "information helped to reassure elderly lady ... to her the diagnosis of [tuberculosis] was tantamount to cancer ... but could say that her rare condition could be treated" (SHO, mediated search).

■ legal or ethical issues: "program involved denying access to fluids ... could be deemed a basic right ... needed to ensure that patient would not be harmed" (staff grade, mediated search).

Comparing Value with previous studies

One objective of the Value project was to explore the optimum method any library and information service could use to examine the value of its services. The Value project results themselves therefore need to be assessed against the results of similar studies.

The Value project interviews were grouped into categories that could be compared with those of the NLM study [20-21]. The categorization scheme was applied to the sixty-one interviews in which patient care and the contribution of information to clinical decision-making were discussed. The three purposes that emerged as most prevalent were "development of an appropriate treatment plan," "recognition and diagnosis of a medical problem or condition," and "quality of life for patient and/or family." None of the case study interviews fit the NLM study category

of "implemented treatment plan." The Value project category of "quality of life for patient and/or family" was similar to the NLM study category of "maintained an effective physician-patient relationship"; the more general concept expressed in the Value project was applicable to future as well as present psychosocial aspects of care.

Clearly, the main similarities in the rank order comparison of the clinical decision-making categories (Table 4) are in the Value project interview classifications and the NLM study categories. The ratios of treatment to diagnosis (about 2:1) are similar (45/22 NLM, 53/27 Value). The similarities are strong enough to suggest that the classification derived in the NLM study is generally applicable, though some variations may be needed to accommodate local conditions.

The major difference between the Rochester study and the other two studies concerns the category "advice to patient," which 72% of the clinicians in the Rochester study checked, while the corresponding categories of "quality of life" or "maintained an effective physician-patient relationship" were chosen by only 10% in both the Value project and the NLM study. This difference may be due to the position of this category (last) in the relevant section of the Rochester questionnaire. (Well-meaning respondents might have been tempted to check the last category if nothing before seemed suitable.) Other contributing factors may be differences in study focus and context. The Rochester study was conducted at a time when hospital libraries were under threat of closure, so some physicians may have felt that positive assessments were desirable.

The emphasis on "advice to patient" in the Rochester study contrasts sharply with other findings in the Value project. Patient education, and provision of information for patients, is a high priority for some practitioners, but few U.K. physicians seem prepared, at present, to seek out information actively for patient education. A need for information to use in patient education was noted in only 6% (26 of 420) of the critical incidents, and fewer than 3% (9 of 361) of the searches and requests were prompted partly by an *inquiry from a patient*. These low values may reflect a lack of awareness of sources available [22] or a lack of suitable U.K. resources that serve professional as well as patient needs. Interviews demonstrated the concern of many clinicians for communication between physician and patients. Given that information for patient education is recognized as a gap rather than a need by many U.K. physicians, the difference between the Rochester study and the Value project findings must be attributed partly to cultural differences.

Cost savings

Results of the Rochester study [23-24] suggested that an increased use of information could help reduce the frequency and severity of adverse patient events. Physicians stated that the information provided by the library contributed to their ability to avoid hospital admission (12%), patient mortality (19%), hospital-acquired infection (8%), surgery (21%), and additional tests and procedures (49%).

The Value interviews, however, illustrated that putting a price tag on the benefit of information is not easy, particularly when benefits accrue to multiple purposes (research, education, and patient care). It is possible to demonstrate cost savings in a specific case, but determining the effective use of resources within the entire organization is more difficult. Thus, the information obtained can provide the signposts and directions for improved care, but the implementation of changes requires discussion with many health care professionals and managers. Interviews showed that while occasional straightforward cost savings can be obtained, the cost-benefit picture is generally more complicated.

Examples of simple cost avoidance include searches performed to verify that the work planned has not been done before: "[The] information showed that work had been done already . . . [the] research proposal hadn't got beyond the thinking . . . stage" (consultant, ILL request). Cost savings also may be achieved by reducing or eliminating a hospital stay: "Administration of antacid treatment could be done on an outpatient basis. . . if this worked, then a hospital stay might be avoided for these patients. . . ." (registrar, end-user search). On the other hand, in-

teresting projects may not be justified in terms of medical benefits. "[We] wanted evidence to critique proposal for flying squad [equipped mobile emergency team] . . . around 100,000 pounds a year would be required . . . believe that no flying squad ever reduces mortality. . . . problem is that only the enthusiasts publish . . . but did find three or four articles, and even two from the enthusiasts did admit there was no medical benefit" (consultant, ILL request).

However, savings made by changing procedures should not increase the chances of adverse effects for patients or increased costs later on. "Patient management for day case tonsillectomy . . . needed background information for general discussion of day case surgery . . . looking at possible complications which might make some patients unsuitable for day case surgery" (SHO, end-user search).

Value guidelines for libraries and information services

Comparison of the various studies on the value of information to clinical decision-making indicates that care must be taken when replicating a study in a different health care context and culture. There is no doubt that the worth of a library and information service can be established in terms that can be related to the organizational objectives for patient care. Having done that, the next question concerns the implications for the future of the information service. Quantitative data on value needs to be complemented by qualitative data. Follow-up interviews provide examples of clinical problems and the clinical decision-making dilemmas, as well as a check on the choice of decision-making categories in a questionnaire. The nonusers of the information service should be tracked, and their patterns of information need and use should be outlined.

QUALITY ASSURANCE: THE VALUE TOOL KIT

The Value project showed that information services have significant effects upon clinical decisions, confirming and extending outcomes of previous studies. However, the results also demonstrated that not all information services are fulfilling their potential. For example, some information services appear to allow a handful of vigorous users to dominate resources while neglecting other groups that, the research shows, would offer greater benefits to patient care, education, or research if supplied with necessary information. Therefore, a tool kit was developed to enable information services not only to assess their impact on clinical decision-making, but also to identify ways in which that impact could be enhanced through improved targeting of services. The tool kit includes

attainable criteria based on a separate audit of more than thirty U.K. health information services, to help information services assess how well they are performing.‡

Sections of the tool kit deal with assessment of user needs, provision of information services, securing evidence of the effectiveness of the service outcomes, and targeting of services. The survey methods are based on those tried and tested in the Value project itself, and the disk supplied with the survey tools allows information services to adapt questionnaires and interview schedules to their needs. The layout of each section follows a standard pattern, which covers the type of information being sought, the supporting research evidence of the need to seek those details about the information service, and the data that will be required. Tool kit users are directed to appropriate survey tools, and advice is provided on how to conduct such surveys.

The main aim of the quality assurance Value tool kit was to improve information delivery to clinicians, but there are also benefits for the information professional. Only by acquiring a deeper understanding of the changes and dilemmas in patient care can health information professionals understand what competencies they must develop to meet the information needs of other health care staff.

REFERENCES

1. KING DN. The contribution of hospital library information services to clinical care: a study in eight hospitals. *Bull Med Libr Assoc* 1987 Oct;75(4):291-301.
2. MARSHALL JG. The impact of information provided by the hospital libraries in the Rochester area on clinical decision-making: final report, a research project funded by the New York State Education Department, Hospital Library Services. Program, Rochester Regional Library Council, Rochester, New York, 1991. Available from Rochester Regional Library Council, 302 N. Goodman St., Rochester NY 14607.
3. MARSHALL JG. The impact of the hospital library on clinical decision-making: the Rochester study. *Bull Med Libr Assoc* 1992 Apr;80(2):169-78.
4. FISCHER WW, REEL LB. Total quality management (TQM) in a hospital library: identifying service benchmarks. *Bull Med Libr Assoc* 1992 Oct;80(4): 347-52.
5. CASADO URIGUEN M, GARCIA MARTIN MA, LA TORRE PM, MONTES DEL OLMO I, ET AL. Importance of hospital library facilities to clinical decision-making by medical staff. Paper presented at EAHIL 1994, 4th European Conference of Medical and Health Libraries, Oslo, 28 June-2 July 1994 (personal communication from Ribes Cot, MF).
6. KLEIN MS, ROSS FV, ADAMS DL, GILBERT DM. Effect of online literature searching on length of stay and patient care costs. *Acad Med* 1994 Jun;69(6): 489-95.
7. MARSHALL JG, 1991, op. cit.
8. WILSON SR, STARR-SCHNEIDERKRAUT N, COOPER MD. Use of the critical incident technique to evaluate the impact of MEDLINE. Final report. Palo Alto, CA: Amer. Inst. Res. Behavioral Sciences, 1989. NLM/OPE-90/01, AIR-64600-9/89-FR.
9. LINDBERG DAB, SIEGEL ER, RAPP BA, WALLINGFORD KT, ET AL. Use of MEDLINE by physicians for clinical problem solving. *JAMA* 1993 Jun 23; 269(4):3124-9.
10. MCSEAN T, ROWLANDS J, FORRESTER W. Becoming a micro-host: using desktop computers to run an online retrieval service. In Raitt DI, Jeapes B, eds. *Online Information '93, Proceedings of the 17th International Online Information Meeting*, London, England, December 7-9 1993. Oxford, U.K.: Learned Information, 1993:367-76.
11. MARSHALL JG, 1991, op. cit.
12. MARSHALL JG, 1992, op. cit.
13. KING DN, op. cit.
14. LINDBERG DAB, SIEGEL ER, RAPP BA, WALLINGFORD KT, ET AL, op. cit.
15. MARSHALL JG, 1991, op. cit.
16. MARSHALL JG, 1992, op. cit.
17. KING DN, op. cit.
18. CASADO URIGUEN M, GARCIA MARTIN MA, LA TORRE PM, MONTES DEL OLMO I, ET AL, op. cit.
19. WOOLF SH, BENSON DA. Medical information needs of internists and pediatricians at an academic medical center. *Bull Med Libr Assoc* 1989 Oct;77(4):372-80.
20. WILSON SR, STARR-SCHNEIDERKRAUT N, COOPER MD, op. cit.
21. LINDBERG DAB, SIEGEL ER, RAPP BA, WALLINGFORD KT, ET AL, op. cit.
22. BRADBURN J, MAHER EJ, YOUNG J, YOUNG T. Community-based cancer support groups: an undervalued resource? *Clin Oncol* 1992 Nov;4(6):377-80.
23. MARSHALL JG, 1991, op. cit.
24. MARSHALL JG, 1992, op. cit.

‡ The tool kit for local audit of information services is available as "The value of information services to clinicians: a tool kit for measurement," from Open Learning Unit, Department of Information and Library Studies, University of Wales Aberystwyth, Llanbadarn Campus, Aberystwyth, Dyfed SY23 3AS, UK; fax, +44-0-1970-622190; dils@aber.ac.uk. The cost is twelve pounds sterling (UK); seventeen pounds sterling for air mail outside Europe.

Received September 1995; accepted December 1995