Important aspects of good systems analysis and evaluation are frequently considered "soft" or "unscientific" because they are neither quantitative nor quantifiable. However, system requirements can be determined and system impacts assessed on a sound, scientific basis by combining qualitative and quantitative methods. This approach goes beyond the usual interviewing of a few key users, and documenting of such quantitative features as work flow, amount of data handled, timing of reports, speed of information retrieval, and cost-benefit ratios.

Although quantitative methods are more commonly used for scientific systems analysis and evaluation, qualitative methods offer a means of obtaining different data also necessary to systems analysis and evaluation. Qualitative methods provide systematic means for assessing application requirements and impacts from the point of view of those involved, thereby adding another dimension to the definitions of system needs and system success. They allow applications to be developed and evaluated in a context in which the application, the users, and the environment into which the application is introduced are all treated as part of a system. Furthermore, by incorporating users' responses to an application into iterative modifications of a system, it can be designed to fit the medical environment better, achieve system goals better, and be more readily accepted by users. This approach takes into account the diverse contingencies of medicine and the variety of responses to a medical computer application, and avoids the rigidities imposed by fully prespecifying a medical computer application.

This panel describes how qualitative and quantitative methods can be combined to take advantage of the strengths of each. Panelists include both medical computer systems developers and social scientists who have been involved in medical computing. The variety of areas they address indicates both the general usefulness of these methods, and the kinds of data that qualitative methods are uniquely valuable in determining.

In addition to panelists' experiences, there have been studies of the ways in which the medical environment can influence the introduction of an innovation. Meeting user needs, as users define them, has been found to be a key determinant of the success of any innovation. In particular, the degree to which medical computer applications fit the values of medical practitioners and the structures of medical institutions affects their acceptance. Values and institutional structures, and their relationships to medical computing projects, cannot be measured and quantified. But methods of discovering user needs and evaluating user responses need not be unscientific or merely anecdotal. They can be scientific. Qualitative methods are a systematic and rigorous way of adding to the understanding obtained through quantitative methods. Panelists agree that, in project design, implementation, evaluation, and management, quantitative methods are not enough.

MAXWELL: The Value of Qualitative Methods

Until recently, quantitative data and statistical or mathematical analysis have been considered the sine qua non of rigorous, scientific investigation and evaluation. This situation is now changing, as more researchers are recognizing the strengths and uses of qualitative methods. "Qualitative methods" refers to methods of gathering and analyzing information that (1) utilize detailed, context-embedded descriptions of activities and settings, and (2) inductively develop categories of description and analysis based on the perceptions of participants in the setting being studied rather than employing the prior categories of the researcher. These methods include interviews, observation, open-ended questionnaires, analysis of reports and other documents, and some forms of unobtrusive data-collection. Research and evaluation designs can effectively combine qualitative and quantitative methods, as long as the strengths and requirements of each type are recognized.

Such methods do not abandon scientific rigor for subjective, impressionistic, or anecdotal accounts. Systematic, rigorous qualitative methods have long been used in the social sciences, but only recently have they become widely employed in evaluation studies. The most important strengths of qualitative methods are (1) the depth and validity of the information they can provide, (2) their potential for uncovering unanticipated influences and relationships, and (3) their ability to produce an analysis that is relevant and
meaningful to the participants in a situation. These strengths are most critical when the context of a computer application is relatively unfamiliar to the analyst, so that prior quantitative specification of variables is seriously incomplete or misleading. Qualitative methods are particularly valuable in planning for and evaluating medical computer applications, since many such applications have failed because of inadequate understanding of the situation in which the application was used or of the attitudes and perceptions of those using it.

KAPLAN: Laboratory Interdisciplinary Systems Analysis

In implementing a laboratory order-entry and results-reporting system, traditional computer systems analysis methods were supplemented by qualitative techniques adapted from the social sciences. The usual methods of systems analysis had uncovered requirements that were easily determined by quantitative methods, and by asking users, but had overlooked latent needs: system requirements that either were so obvious to users that no one thought to mention them, or were integral, but non-obvious, aspects of laboratory function. Qualitative methods helped determine such important influences on user acceptance as (1) users' skills and their fit with system design, (2) effects on social interaction among laboratory members, (3) users' misconceptions or apprehensions concerning the introduction and use of a computer, and (4) actual laboratory workload and flow. By incorporating these findings into further cycles of application development, and by taking corrective steps when unanticipated situations occurred, the designers modified the system from one that users did not initially accept into one that users did.

Participant observation and unobtrusive measures proved to be the two most useful techniques employed to discover these kinds of system requirements. Participant observation, or direct fieldwork, allows the researcher to study social situations of concern and system use. Information about system use was also gained unobtrusively by examining hard-copy data entry so that errors and problems could be traced, and system use could be "observed" without researchers being present. These techniques were helpful because (1) they treated the laboratory as a social system; (2) application needs and users' responses cannot be totally specified in advance; (3) they allowed latent as well as manifest requirements to be met; and (4) they involved users as full partners in system development.

Quantitative measures (e.g., work-load reduction, cost savings, system throughput, ease of data entry, forms-completion errors) of medical decision support system performance are often touted as proving the success or acceptance of such systems. However, when qualitative aspects of system impact (e.g., uses to which data are put, impact on job or role perceptions, accuracy of data or reports, impact on quality of care) are considered, many of these same systems are dismal failures.

Medical decision support systems are tools that are being used more and more by quality assurors, administrators, and clinicians both to measure clinical performance and to insure high standards of care. As a medical decision support system graduates from a simple information provider to a participant in the service delivery process, it follows that its impact will be more pervasive. Hence, system evaluators, during initial and follow-up phases of implementation, must adopt a wider perspective than that traditionally taken by evaluators using computer system performance measurement tools.

Such "holistic", in coin a term, attempts at computer system evaluation should be purposeful attempts at determining the impact of the system on its environment, with an eye toward making that environment function more effectively, albeit at a level higher than the one that existed prior to the implementation. System assessment defined within this broader context will require defining and monitoring a host of variables beyond system performance, and then making adjustments to the computer system or to the workings of the environment itself. These adjustments should, in turn, stimulate further monitoring and perhaps fine-tuning iteratively until all the effects of the original installation are worked through.

The Current Systems Assessment (CSA) is the tool by which systems developers analyze the component functions of an activity, e.g., drug prescription monitoring. From the holistic perspective, the CSA, while becoming more complex, also becomes more crucial. Conducting a CSA involves first determining, then periodically measuring (rigorously), sets of personal, organizational, and computer system-oriented variables deemed indicators of "system" performance (see, for instance, those listed above and in Scheirer, 1981). Based on the results of these studies, or probes, either the system is modified to suit its environment better or the environment is revised via policy directives or educational interventions.

Unfortunately, not all characteristics of an environment are amenable to quantification or rigorous measurement. For example, clinician satisfaction can be measured by some sort of tool developed by implementors or evaluators; however, no such tool has ever been able to satisfactorily measure all dimensions of satisfaction. At this point, the evaluator or implementator
must become more accepting of narrative, non-quantitative data, and listen with the third ear which has, up to now, been owned solely by psychotherapists.

This presentation will look at the CSA in this broader context and describe methods by which it is conducted. Though a major focus of this presentation will be on defining some qualitative measures of system performance, other foci will be on dealing with the complexity that this larger context brings, and how to collect and express qualitative measures rigorously.

**FISCHER: PROMIS Ethnographic Evaluation**

Evaluation of medical information systems (MIS) poses basic methodological problems which arise from the scope of the systems themselves and from the complexity of the environments in which they are implemented. Hospitals have complicated organizational structures that encompass not only the technological sphere but also the more complex and rigidly defined sociocultural milieu into which the system must be integrated. In the case of PROMIS the purpose of the evaluation was to document whether, and to what degree, provider performance in a general ward setting would be influenced by the implementation of the medical information system.

It was hypothesized that the effective utilization of the computerized system by health-care providers in the hospital setting might vary with (1) experience and familiarity with the tool, (2) commitment to the philosophical premises upon which the tool is based, (3) the user's willingness to adhere to system conventions, (4) the purpose and motivations of the user, (5) situational variables such as time of day, workload, and case complexity, and (6) hierarchical relationships of users relative to system demands, e.g., alteration of usual chains of command or information exchange. These variables could interact in a number of complex ways, making interpretation of differences that might emerge from quantitative methods of analysis alone, e.g., comparison of alternate record systems, forced-choice survey instruments, or time-activity studies, difficult without the contextual factors that generate these differences.

In order to combat some of the potential analytic problems, an array of observational, interview, and other standard ethnographic data-gathering techniques was devised to document the evolution of the system and to compare the observable effects of the computerized medical record on the demonstration ward with parallel data obtained from a control ward. Participant observation formed the chief technique for the qualitative portion of the evaluation. By observing and interacting with house staff and other groups of users in their natural setting, observers were able to achieve the insider's perspective on attitudes and behavior for combination with the observer's own systematic analysis of data. Participant observation will be discussed in terms of (1) observer techniques for gaining acceptance and "invisibility" within the user milieu, (2) systematizing data collection, (3) methods of ensuring reliability of observations, (4) effect of participation on observers, (5) fusion of qualitative methods with quantitative data, and (6) importance of qualitative data in evaluation of medical information systems.

**Bibliography**


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