# 4
# Survey Methods for Assessing Social Impacts of Computers in Healthcare Organizations

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## Introduction

This chapter provides a guide to the use of survey methods in evaluating the potential impacts of computerized information systems on the functioning of healthcare organizations and the work life of the individuals within them. In any setting, the impacts of computing go beyond the efficiency or cost-effectiveness of a system to the ways in which the technology interacts with the organization's ongoing routine policies and practices [1–4]. Because the delivery of healthcare requires coordination and cooperation between numerous different occupations and departments, changes in how these groups perform their work and interact with one another can have important consequences for the organization as a whole. Furthermore, the emphasis on cost efficacy, quality improvement, and patient safety has increased the demand for computer systems to improve patient safety, reduce costs, and provide new and better information to administrators and healthcare providers. In the long term, new computer technology has the potential to change the experience and process of work as well as the structure and delivery of medical care.

The chapter draws from studies of healthcare computing, as well as from research on computing in other types of organizations, to suggest potential areas for investigation and appropriate measures. The examples described were selected to illustrate specific evaluation issues and methods and are not meant to comprise a comprehensive review of the literature. The discussion includes the evaluation of immediate system outcomes as well as some of the work-oriented long-term impacts of new systems. Although other methodologies are mentioned, the present chapter focuses primarily on quantitative survey methods to measure system impacts.

When the first edition of this book was published in 1994, much of the research on computers in healthcare had focused on the efficiency of the systems themselves, with little attention directed toward their potential social impacts. Although research on information systems in other settings had traditionally been problem-oriented as well, there was also a significant

body of research on the social impacts of computer technology [5–6]. Some of these issues have more recently begun to appear in healthcare literature as well. While the field is constantly changing, the studies cited here provide researchers and system evaluators with a starting point to conduct further literature reviews for the newest studies on the topics discussed, as well as an appendix with selected instruments (including several new to this edition) available for use as appropriate to each setting or system.

## Survey Research

Survey research, one of the most common methods used for evaluating information system impacts, involves gathering information from a sample of a population using standardized instruments [7]. For scientific purposes, the intent of survey research also includes generalization to a population of individuals extending beyond the organization under study. In evaluation research, however, the sample may not be randomly selected and the population may be limited to individuals within a specific organization. Even in the case of convenience samples within a single organization, however, investigators need to take steps to ensure an adequate and representative response from individuals comprising the groups in question.

A survey or questionnaire is the primary data collection method within survey research [7]. In designing any project, questionnaires should never be developed from scratch when appropriate instruments already exist [8]. The use of a standard measure with established validity and reliability allows comparison of scores with other settings and spares the investigator the time-consuming process of developing a new measure [9]. (*Validity* may be defined as the extent to which the measure actually captures the concept it purports to measure, whereas *reliability* refers to the extent to which it is free from measurement error.)

The survey instruments described in the present chapter are drawn primarily from literature on information systems, organizations and organizational development, and work attitudes and values. The examples selected for inclusion either have been developed specifically for healthcare organizations or are widely used in other organizational settings with documented reliability and validity. In most cases, the instrument is included in its entirety in the chapter appendix. In other instances, references are provided to enable the investigator to obtain the instrument. This chapter is divided into sections detailing measurement strategies for: (1) user reactions to information systems and the implementation process; (2) characteristics of users that may influence their attitudes toward the system and system implementation; and (3) assessments of social impacts of computers organized into the following six dimensions: decision making,

control, productivity, social interaction, job enhancement, and work environment [5].

## User Reactions to Computers and Implementation: General Measures of User Satisfaction

Assessing user satisfaction with a new computer system and the system implementation process constitutes a first step in information system evaluation. A user satisfaction survey should not be seen as a definitive evaluation; it provides a starting point for analyzing system impacts and identifying possible areas of conflict and dissatisfaction [9]. Research has shown that user involvement in the computer implementation process improves both use of and satisfaction with information systems (see Kraemer and Dutton [6] for summary information). Thus questions about the level of involvement in implementation and satisfaction with computer training are often included in user satisfaction measures. Furthermore, users who hold realistic expectations about an information system prior to implementation also tend to use the system more and be more satisfied with it [6]. However, those with unrealistically high expectations prior to system implementation may become disillusioned with the system when the final product fails to meet their expectations, emphasizing the importance of an ongoing evaluation strategy that measures user attitudes both before and after system implementation [10,11].

### *User Information Satisfaction Scale*

Baroudi and Orlikowski's [9] short form of Ives, Olson, and Baroudi's [12] User Information Satisfaction Scale is one of the few measures in the information systems literature that meets strict criteria for a well-developed survey instrument [8]. The scale includes 13 paired items measuring user satisfaction with: (1) the data processing staff and services, (2) the information product, and (3) their own knowledge and involvement (see Instrument 1 in the Appendix).

The User Information Satisfaction Scale, widely used in settings outside of healthcare, is intended to provide the investigator with a tool to detect problems with user satisfaction and facilitate investigation of specific trouble spots pinpointed by the individual scale items. The investigator may want to compare the responses of individuals in different groups or departments on different scale components or specific items to assess how well the new computer system meets the needs of different user groups. In addition, comparative data from surveys conducted in a number of different settings are available.

Because it was designed to save time, the questions on the survey are brief. For clarity, it may be necessary to modify the questionnaire for the specific computer system or organization. The investigator may also wish to add additional items, although the changes may compromise the established validity and reliability of the instrument [9].

## *End-User Computing Satisfaction*

Doll and Torkzadeh's measure of End-User Computing Satisfaction [13] is another of the few measures in the information systems literature meeting strict criteria for a well-developed survey instrument [8]. The concept of end-user computing addresses applications in which the information users being surveyed actually use the computer terminal themselves. Thus, the measure focuses on issues such as ease of use and satisfaction with a specific computer application rather than involvement in implementation and relations with data processing staff [13]. The measure provides Likert-type scaling as an alternative to semantic differential scaling and includes the following five factors: (1) content, (2) accuracy, (3) format, (4) ease of use, and (5) timeliness (see Instrument 2).

Doll and Torkzadeh also address the issue of user involvement in system development in the end-user computer environment [14]. The authors hypothesize that successful involvement depends not only on the amount of involvement but also on the user's actual desire for involvement. They suggest asking system users questions describing both (1) the amount of time *actually spent* participating in specific development activities, and (2) the amount of time they wanted to spend in development activities, on a 5-point scale ranging from "a little" to "a great deal" (p. 1163) [14].

## *Implementation Attitudes Questionnaire*

Schultz and Slevin took a different approach, developing a comprehensive attitude measurement instrument by examining general research on organizations to determine which variables would be relevant to the implementation of information systems in the organizational environment [15]. Their final instrument, based on factor analysis results, includes seven areas of impact (see Instrument 3). The questionnaire also includes five dependent variables measuring the respondent's likelihood of using the system and evaluation of the system's worth. Robey describes the results of several studies using the Schultz and Slevin instrument [15,16].

## *Innovation Process*

A different approach to analysis of computer implementation in healthcare is to focus on the innovation process. Both Snyder-Halpern and Hebert and Benbasat, whose instruments have been added to the appendix to this

chapter, explore different aspects of the innovation process. Snyder-Halpern's Organizational Information Technology/Systems Innovation Readiness Scale (OITIRS), included as Instrument 4, focuses on the readiness of the organization for clinical information technology [17,18]. Hebert and Benbasat, on the other hand, use a research model adapted from Moore and Benbasat that borrows from both Rogers's adoption of innovations and Fishbein and Ajzen's theory of reasoned action [19–22]. This theoretical framework forms the basis of their survey addressing potential use of bedside terminals by nursing staff (see Instrument 5, "Point of Care Technology").

## *Adding Other Measures*

The investigator can also include components of the implementation process not covered by the scales described above. Aydin and Rice [23], for example, used items developed by Taylor and Bowers [24] to assess (1) work group communication (i.e., discussions with co-workers and management about ways to apply or adapt the system) and (2) organizational policies (i.e., the extent to which the organization supports the system by allowing individuals time to experiment and learn more about it). (See Instrument 6.) Such organizational policies and communication support can influence the extent to which individuals develop their own methods for using the system in the process of adoption and implementation (i.e., "reinvention") [21,25].

## *Single-Item Measures*

Baroudi and Orlikowski also suggest that there may be instances in which it is appropriate to employ a single-item measure of user satisfaction [9]. Although single-item measures have been criticized for possible measurement error and lack of discriminatory power (e.g., Zmud and Boynton [8]), research also shows that single-item global measures may be more inclusive and convenient than the summation of many facet responses [9,26].

Following this line of reasoning, Rice and Aydin used a single-item measure in their evaluation of computerization in a student health clinic [27,28]. Based on Schultz and Slevin's [15] conclusion that an individual's cost-benefit evaluation was one of the most useful measures of perceived system success, respondents were asked to indicate their level of agreement (on a 7-point scale ranging from "strongly disagree" to "strongly agree") with the following question: "The new information system is worth the time and effort required to use it." In addition to the single-item measure, two additional questions were added after the computer was implemented asking respondents to rate the extent to which the system increased (1) the ease of performing the department's work and (2) the quality of the department's work (see Instrument 7). The three items together comprise a short

global scale combining a general cost-benefit evaluation with an evaluation of the system's contribution to a department's work [10,29].

## Measuring User Adaptation

Kjerulff, Counte, Salloway, and Campbell adopted a different approach to user satisfaction by developing three instruments to assess employee attitudinal and behavioral adaptation to computerization. Employees themselves completed the Use Scale and the Change Scale while supervisors completed the Behavioral Scale for each employee using the computer (see Instrument 8) [30]. Study results described the relationship of these measures to other standardized measures such as cognitive structure, role conflict, and role ambiguity [31]. (see Cook, Hepworth, Wall, and Warr for additional job measures such as role conflict and ambiguity) [32]. Findings for the Use Scale, for example, indicated that greater difficulty in using the system was reported by employees who faced more ambiguity in their jobs, had a negative orientation toward change and little desire for routine or structure, and a history of working at a number of different hospitals.

## Level of System Use

Level of system use can also indicate user satisfaction with an information system, especially when system use is discretionary [33–35]. Even with mandatory systems, however, user satisfaction with the system may determine how well they use it. How frequently an individual uses the system can also affect attitudes toward the system. Nonusers or infrequent users, for example, may not be familiar enough with a new system to realize its strengths and shortcomings. Frequent users, however, may report changes in their daily work such as an increased workload or new communication with other workers to discuss system functions and issues [23].

Measuring system use often requires system-specific questionnaire items. Schultz and Slevin, for example, asked prospective users to indicate the probability that they would use the computer system (see dependent variables on Instrument 3 in the appendix) [15]. Anderson, Jay, Schweer, and Anderson asked physicians to respond to items such as: "How frequently do you *personally* use MIS to retrieve patient lists?" and "How frequently do you *personally* use MIS to enter medical orders?" using the following scale: 5 = "several times a day," 4 = "daily," 3 = "several times a week," 2 = "weekly," 1 = "less than weekly, but occasionally," and 0 = "never" [36,37]. Aydin and Ischar asked nurses "When medications are entered on the computer for the patients you are assigned to care for, what percent of these are entered within two hours after the order is written?" on a scale of 0%, 10%, 20%, and so on [38]. In 1998, Cork et al. reviewed available measures of physician use of, knowledge about, and attitudes toward com-

puters [39]. System use can also be monitored through online tracking of how frequently individuals log onto the system and/or how long they use it each time they log on [33–35]. Online tracking can also provide measures of communication relationships among users or how individuals used common features of the system (see Chapter 5 of this book).

## Provider–Patient Interactions

A frequently voiced theme of physician or healthcare providers when considering implementation of an electronic medical record has been the concern that computers will have a detrimental effect on the provider–patient rapport, depersonalizing the interaction [40]. (See Chapter 10.) Some research has addressed this issue from both the provider and patient perspective. Results showed that, while patients did not perceive any loss of communication or rapport with providers, recent studies report that both providers and patients were concerned about confidentiality about the electronic medical record. Instrument 9 in the appendix addresses a selection of these patient–provider issues.

## Situation-Specific User Satisfaction Measures

Kaplan and Duchon's investigation of a computer system's impact on work in clinical laboratories illustrates another approach to measuring user satisfaction [41,42]. Rather than using a general satisfaction measure, Kaplan and Duchon designed an instrument to measure specific expectations, concerns, and perceived changes related to the impact of the computer system on laboratory work. Although the items may not be applicable to all systems, the questionnaire (Instrument 10) should guide investigators in developing similar situation-specific measures. The survey form also included open-ended items such as: "What important changes do you think the computer system has caused?" and "In what ways has the computer system affected how the labs and technologists are treated by others in the Medical Center?" Kaplan and Duchon used the instrument in combination with both standardized measures of other job dimensions (see the section on job enhancement below) and qualitative measures of system impacts.

## *Combining Standardized Survey Items*

Many researchers combine scales from standard measures with established reliability and validity such as those published in the appendix to this chapter to create a survey that meets the needs of their specific study. Aydin et al. used this approach to develop a survey to provide pre- and postmeasures of user acceptance of the WatchChild obstetrical and fetal monitoring system. Instrument 11 in the appendix was developed as a pre-

measure and distributed and collected during WatchChild training [43]. Results showed positive responses to most items and the postmeasure (Instrument 12) was very short, focusing only on the most essential items from Instrument 11. The source for each of the items in Instrument 11 was as follows:

*Survey item 1*: Instrument 7 in appendix.
*Survey items 2–14*: "Performance and visibility" (coefficient alpha = .95, mean response = 3.97). Adapted from Instrument 3 in appendix.
*Survey items 15–17, 20–23*: "Support" (coefficient alpha = .86, mean response = 3.83). Adapted from Instrument 3 in appendix.
*Survey items 18–19*: "Resistance" (mean response = 3.1). Adapted from Instrument 3 in appendix.
*Survey item 24*: "Service Outcome." Adapted from Instrument 10 in appendix.
*Survey items 25–26*: "Negative Intentions" (coefficient alpha = –.90). Adapted from Instrument 10 in appendix. Positive item (26) reversed to create scale.
*Survey items 27–31*: "Personal Hassles" (coefficient alpha = .85, mean response = 2.77). Adapted from Instrument 10 in appendix.
*Survey items 32–34, 41*: Developed specifically for this study. Used as single items, not scale.
*Survey items 35–39*: "End User Satisfaction" (coefficient alpha = .93, mean response = 4.16). Adapted from Instrument 2 in appendix.

## Characteristics of Individual Users

The characteristics of individual users can help system implementers predict individual attitudes toward an information system. Individual attributes are those such as age, occupation, education, job tenure, previous computer experience, prior attitudes toward computers in general, and personality variables such as cognitive style, learning style, orientation toward change, or cognitive structure. Outcomes, however, are not always predictable. Age, job tenure, and previous computer experience, for example, have been shown to lead to both positive and negative attitudes in different settings. For example, although individuals who have worked in an organization for many years often find change difficult, Counte et al. found individuals who had a history of working in a larger number of hospitals had greater difficulty in using a new system [31]. Although less computer experience may predict negative attitudes, the lack of standardization between computer systems may also make it difficult for experienced computer users to adapt to a new system. Measuring these background factors enables the investigator to either eliminate them or document their influence when investigating reasons for computer-related problems and issues.

## Personality Factors

This section addresses user personality traits and the implementation of information systems. Whereas copyright restrictions do not permit publication of the measures themselves, specific references are provided at the end of the chapter to obtain copies of the measures.

### *Cognitive Style/Learning Style*

Beginning in the 1970s, a number of investigators began to focus on traits such as cognitive style as an issue in the design of information systems [44–46]. "Cognitive styles represent characteristic modes of functioning shown by individuals in their perceptual and thinking behavior" (p. 967) [47]. Most models distinguish between an individual's analytical, systematic approach to problem solving and a more intuitive, global approach as the two main types of cognitive style. Overall, this line of research has had limited success, with generally inconclusive findings regarding information systems design and use [48–50]. Meta-analytical findings indicate that the impact of cognitive style on implementation success is relatively small, with a stronger impact on user attitudes than on user performance [51].

In the healthcare arena, for example, Aydin found a relationship between cognitive style, as measured by the short form of the Myers-Briggs Type Indicator, and self-reported use of a newly implemented order entry system [52,53]. Results showed "feeling types" reported that they used the computer less than did "thinking types." Subsequent studies, however, found no relationship between cognitive style and self-reported use [10,38,52].

Cognitive style or learning style may, however, be important in the design of effective training for computer users [49]. Bostrom, Olfman, and Sein recommend giving the Kolb Learning Style Inventory to potential trainees and using the results to ensure accommodating the mix of individuals in the group [49,54]. Summers makes a similar recommendation for educating nurses [55]. A series of experiments on field-dependence/independence (i.e., the degree to which an individual can isolate or differentiate patterns from a complex field) also resulted in recommendations for information system components to make disembedding easier to perform [48]. Chapter 6 of this book addresses recent cognitive approaches to evaluation in detail.

### *Orientation Toward Change/Cognitive Structure*

Approaching personality traits from a different perspective, Counte et al. asked users to complete two personality subscales from the Jackson Personality Research Form: orientation toward change and cognitive structure [31,56,57]. The first subscale measures general acceptance of change; the second measures a need for order and structure in one's life [31,56].

Results showed that employees who had a negative orientation toward change of any kind and little desire for routine or structure in their daily lives had greater difficulty in using the new computer system. Since personality is, by definition, not highly subject to change, the authors concluded that individuals who are less adaptable may need more time and support during training and implementation [56].

## Social Impacts of Computers

The preceding sections of this chapter have covered instruments to assess user satisfaction with a computer system, as well as some of the individual traits and attitudes that may help predict user satisfaction. The following sections suggest ways to measure the impacts on work life that may be experienced by computer users. Impacts are divided into the six dimensions cited by Kraemer and Danziger (p. 594) [5] as the most commonly identified impacts of computing on work:

1. *Decision making*—the capacity to formulate alternatives, estimate effects, and make choices
2. *Control*—the power relations between different actors
3. *Productivity*—the ratio of inputs to outputs in the production of goods and services
4. *Social interaction*—the frequency and quality of interpersonal relationships among co-workers
5. *Job enhancement*—the skill variety and job domain
6. *Work environment*—the affective and evaluative orientations of the worker toward the setting of work

Since much of the research has been conducted outside of healthcare, each section begins with a brief summary of findings in other settings, followed by examples of research in healthcare along with suggestions for measurement and additional research.

## Decision Making

Kraemer and Danziger (p. 594) define *decision making* as "the capacity to formulate alternatives, estimate effects, and make choices" [5]. Results of research in other settings indicate that, although computers provide workers with higher quality and more accessible information for decision and action, expert systems that actually make decisions or aid human decision makers remain elusive. In healthcare, decision support systems may aid in diagnostic decision making as well as interpret, alert, and make therapeutic suggestions. Langton, Johnston, Haynes, and Mathieu (p. 629), in their review of prospective studies that use control groups, assert that very

little of the literature focuses on evaluating their "effects on real patients when used by clinicians in everyday practice" [58].

One area in which the medical decision-making capabilities of computers have received considerable attention, however, involves computerization in inpatient, particularly intensive care unit (ICU), settings [59]. Specifically, studies have focused on the *clinical* impacts of systems that provide clinicians with reminders, pharmacy and laboratory alerts, infectious disease monitoring, perioperative antibiotic use, and utilization assessment [61–67]. The success of such systems, documented by the studies cited above as well as much subsequent research, has led to the current emphasis on the importance of clinical reminders and alerts for patient safety.

Understanding the impact of computers on decision making goes beyond expert systems, however. One of the most important purposes of computerized order entry and results reporting, for example, is to provide the clinician with faster and more accessible information for clinical decision making [34,68,69]. Thus the assessment of user satisfaction with the availability of information for decision making could be supplemented by measures such as the actual elapsed time between when the order is written and when the results are available to the physician for clinical decisions on patient care. One medical center, for example, documented an average delay of 107 minutes between the time a physician wrote a TPN (total parenteral nutrition) order and the time the order was entered in the computer by the unit clerk [70]. This delay was eliminated with the implementation of physician order entry. The success of the change depended, however, on physician acceptance of order entry, which may be lacking in other institutions and remains an issue in medical informatics. In 1994, Sittig and Stead reviewed the "state of the art" of computer-based physician order entry and the *Journal of the American Informatics Association* focused the entire March/April 2004 issue on "Perspectives on Computerized Physician Order Entry (CPOE) and Patient Care Information Systems" [71,72].

In addition to the timing of information, the amount of information available can affect the decision-making ability of healthcare professionals [73]. Radiologists, for example, emphasize the importance of knowing physicians' reasons for requesting specific tests to ensure that the appropriate test has actually been ordered and to assist in their interpretation of results. An important factor in radiologists' acceptance of the PROMIS system was the ability of PROMIS to provide the radiologist with the complete patient record on demand, enhancing their decision-making capability [73].

The complex division of tasks between departments, however, may increase the difficulty of implementing systems to transmit information from one department to another. Order entry for radiology, for example, may require that the individual entering the radiology order in the computer include the reason for the test as well. The physician, who may not enter his or her own orders, also may not have included the reason for ordering the test on the written order form. If the physician is no longer

accessible when the clerk enters the order, the clerk may simply hazard a guess to fill the space so the computer will accept the order. In this case, the system has the capability to meet the radiologists' needs, but the organization of tasks and the unwillingness or inability of the physician and clerk to provide the required information may result in errors in tests performed and interpretation of films [74].

Several items designed to measure the decision-making aspects of a system are included in the Schultz and Slevin measure (see Instrument 3, especially Factor 1). (The instrument was originally pilot tested with a computer system for making advertising budgeting decisions.) User satisfaction measures may also reflect decision-making issues if radiologists, for example, indicate dissatisfaction with the information provided by the system. Follow-up to uncover specific problems then could include an audit of system use, interviews, and observation of individuals as they work with the new computer system.

## Control

Kraemer and Danziger define several aspects of control that warrant consideration, including: (1) control of the individual's work by others, (2) the individual's ability to alter the behavior of others, (3) constraints imposed by the job itself such as time pressures, and (4) an increased sense of mastery over one's own work [5]. The control aspects of computerization need not be conceived of as "zero sum," however, but can result in increased control by all groups [75,76].

Research in settings outside of healthcare has shown that computing has had minimal impact in control over people in the work situation, perhaps because few systems to monitor employee work are actually implemented and monitoring capabilities are seldom used [5]. In the healthcare arena, computer systems that have the capability to either monitor or control physician ordering patterns have the potential to shift more control to institution administrators. In the example described above in which physicians began entering their own TPN orders in the computer, evaluation results showed a significant increase in physician compliance with hospital policies on the type and duration of orders. In fact, the computer was diplomatically referred to as a "teaching tool" and guidelines were printed on the computer screen where the physicians made their selections, but the end result was enforcement of physician compliance with medical center policies [70].

In a similar vein, computerized order entry and results reporting provide an opportunity for both peer review and quality assurance operations, as well as a "teaching tool" to encourage the use of practice guidelines [77]. How frequently these capabilities are actually used, however, remains an open question. Evaluation of these aspects of computerization may involve examination of organization policies on the use of computer information; inter-

views and surveys of key officials, physicians, and other administrators; and audits of changes in compliance with institutional policies and guidelines.

The adoption of a centralized system such as order entry and/or results reporting might also be considered to enhance administrative control over all departments in the organization simply because, whatever system is selected, it is likely to involve compromises on the part of individual departments to meet the needs of the organization as a whole. In fact, Aydin, using interviews with key administrators and system users, found that pharmacy departments perceived a loss of control over both the database of physician orders on which they depended to perform their work, as well as their department's revenues, when nurses were assigned the tasks of order entry and computerized charting of medications [78]. To regain at least some control, the pharmacy department in one hospital agreed to accept what they considered to be a "nursing system" only after hospital administration agreed to let them resume the pharmacy's expanded consultative role that had been eliminated during budget cuts. In another hospital, the pharmacy used system audits to demonstrate nursing errors in order entry and convince administrators that it would be cost effective to assign pharmacy order entry to pharmacy technicians instead of to nursing, effectively shifting control of the orders database back to the pharmacy department [79].

Both interviews and observation of the meetings that occur during system adoption and the implementation process can provide important evaluation information on shifts in control and the negotiations that occur between the respective groups. In addition, evaluation surveys distributed both before and after system implementation might include situation-specific questions regarding the amount of control an individual or department has over specific aspects of the work situation. For example, individuals might be asked: "For each of the following decisions, please indicate how much say you actually have in making these decisions" on a scale of "no say at all" to "a very great deal" [80]. The question would be followed by a series of items such as "decisions about changing how you do your work," as well as situation-specific items that might be affected by computerization. Schultz and Slevin also include several items measuring impacts of computerization on control (see Instrument 3, especially Factor 1).

Finally, the use of computers also has the potential to shift the power relationship between physicians and patients. Although little research has addressed this aspect of computerization, there are at least two possible scenarios [81]. On one hand, the physician may consolidate his or her position as an expert by becoming better informed but releasing only decisions to the patient. On the other hand, the computer may be used to share information with patients and involve them in decision making about their healthcare [81]. Survey instruments designed to measure patient perceptions of the consultation process may be used to address potential shifts in the power relationships between patients and healthcare professionals (see Instrument 9) [82,83].

## Productivity

Research on changes in productivity accompanying computerization in settings outside of healthcare indicates that there has been little displacement of workers with the increased productivity made possible by computers. Rather, the same number of workers tends to handle more work, with productivity gains from increased quality of work and reduced errors in information handling [5]. Most studies agree that the quantity of work has substantially increased, with more mixed results on the quality of work.

In the healthcare arena, nursing research, in particular, has focused on the impacts of computers on the time and quality of nursing work [84]. In general, results show that computers save nurses time in performing clerical activities such as filling out requisition slips and assembling charts [85]. Computers that manage the flow of information between nursing and ancillary departments save time for nurses, whereas systems that emphasize online charting and not communications may not save time [86]. Also interesting, however, is the finding that the extra time available after computerization is not usually spent in direct patient care as hypothesized but is channeled into other areas, such as professional growth activities, inservice education, and management planning, or spread out across other nursing activities [85,87]. In studies outside of nursing, Counte, Kjerulff, Salloway, and Campbell measured how individuals using an Admission, Discharge, and Transfer (ADT) system apportioned their time on the job before and after computer implementation [88]. Respondents were employees in all hospital departments, most in clerical positions or lower-level supervisors, who were trained to use the system. Findings showed that system implementation decreased the amount of time employees spent helping other departments acquire information while, as expected, increasing the time spent on data processing (see Instrument 13). Andrews, Gardner, Metcalf, and Simmons also addressed work patterns, quality and content of charting, and productivity in their evaluation of a respiratory care computer system [89]. Survey questions included asking therapists to compare the amount of time spent charting before and after computerization, as well as a number of other questions comparing manual and computerized charting (see Chapter 15 of this book).

Computers also have the potential to increase the quality of information work by reducing errors. In considering nursing work, however, Hendrickson and Kovner note that few studies have been conducted to examine this effect [86]. Instruments 3, 7, and 10 in the appendix include some questions addressing respondent perceptions of changes in quality and service attributable to computerization in both general and laboratory settings.

Getting data into the computer in a timely, accurate, and efficient manner also remains an overriding issue in the implementation of medical information systems and especially the computerized medical record [90,91]. Issues surrounding the accuracy of order entry, for example, illustrate some

important concerns. With computerized order entry, a clerk with limited expertise may enter orders in the database by selecting from menu options that may not match the exact terminology used by the physician [74,90]. Audit data can enable system implementers to determine the need for additional training of individual employees or entire groups. In one hospital, audit results indicated that initially 60% to 70% of the medication orders entered required changes by the pharmacy, a figure that was later reduced through training provided to clerical employees by the pharmacy department [78]. Concerns for patient safety have led to a renewed emphasis on the universal implementation of computerized physician order entry (CPOE) systems to eliminate errors attributable to employees with less knowledge entering physician orders.

Another essential measure of the productivity of today's hospitals is patient length of stay. Kjerulff (p. 244) [87] cites an experimental study in which two intensive care units were carefully matched for staffing and patient characteristics. Results showed that patients on the computerized unit had shorter lengths of stay with computerized data providing "better blood management." Although length-of-stay data should provide readily available outcome measures in most institutions, well-designed studies are needed to control for patient acuity and other variables in determining the impacts of computerization on patient care.

## Social Interaction

Social interaction is defined by Kraemer and Danziger (p. 594) as the "frequency and quality of interpersonal relationships among coworkers" [5]. Research on computer impacts has documented increased interdependence and communication between individuals and work groups connected by computers. Individuals use electronic mail to send information that would not have been sent or received without electronic mail and individuals who share common databases meet face-to-face as often as before computerization to discuss the shared system [5].

Some of the evidence cited above comes from research in healthcare organizations. Aydin [78], for example, showed that dependence on a common database and shared tasks can increase interdependence and cooperation between departments (see also Connelly et al. [92], Pryor et al. [69]). Anderson and Jay used network analysis to study social interactions between healthcare professionals as predictors of system use (see Chapter 8 of this book) [93]. Results showed that physicians' location in a communication network had a significant effect on the adoption and utilization of a hospital information system independently of background and practice characteristics. In a smaller organization, Aydin and Rice focused specifically on the communication aspects of implementing a new clinic scheduling system [23]. Findings showed that workers created new contacts and learned more about the work of computer users in other parts of the

organization. These increases in communication also have implications for productivity when combined with findings that indicate that the more coworkers an individual talks to about the new technology, the more productive he or she is likely to be using the new system [94].

New patterns of communication between workers may not all be positive, however. New task arrangements can also create new problems or continue old conflicts in new guises. Kaplan highlighted interdepartmental issues in her study of the implementation of a laboratory computer system [95]. Although respondents agreed that the computer system made results available more quickly, some laboratory workers felt a loss of contact with physicians, nurses, and patients. In addition, some physicians and nurses refused to use the terminals for results inquiry. Laboratory workers felt that these physicians and nurses expected to get test results by telephone and resented being referred to terminals or to a central processing area for their information.

Both survey research and network methods, as well as interviews and audits of system use, can be used to evaluate changes in social interaction accompanying computerization. Schultz and Slevin (1975) and Kaplan and Duchon both include questionnaire items to explore impacts of computerization on changes in communication patterns and issues (see Instruments 3 and 10) [15,42,96]. Instrument 13 also includes communication in the list of work role activities being evaluated, and Instrument 14 provides an example of a questionnaire used to collect information on respondent contacts for network analysis (see Chapter 8). Instrument 15 provides a sample measure to document changes in the frequency of telephone contacts between departments. In addition, documentation of changes in interdependence may be measured by asking employees (both before and after computer implementation) questions such as: "How much do you have to depend on each of the following people to obtain the information needed to do your work?" The question is followed by a list of individuals or departments involved in the computerization process and response categories ranging from 1 to 4, "not at all" to "very much" [97].

## Job Enhancement

Job enhancement, in contrast to the broader concept of work environment addressed below, focuses specifically on job content, particularly the variety of different tasks and level of skills for a given job [5]. One of the early debates related to computerization concerned whether the use of computers would reduce or expand the task variety and skills associated with specific jobs. Attewell and Rule, for example, note that although some investigators argue that low-level clerical jobs can largely be replaced by new technologies, others argue that even the lowest stratum of white-collar workers may benefit from retraining schemes to upgrade their jobs [75].

According to Kraemer and Danziger, most of the research indicates that, particularly for jobs that involve diverse skills, computing has enhanced workers' perceptions of their job domain [5].

Research on job design usually focuses on five specific components [98]:

1. *Skill variety*—the degree to which a job requires a range of activities and abilities to perform the work
2. *Task identity*—the degree to which a job requires the completion of a relatively whole and identifiable piece of work
3. *Task significance*—the degree to which a job has a significant impact on other people's lives
4. *Autonomy*—the degree to which a job provides freedom and discretion in scheduling work and determining methods
5. *Feedback about results*—the degree to which a job provides employees with clear and direct feedback about task performance

Hackman and Oldham developed the Job Diagnostic Survey (included in Cook et al. [32]) to measure these core job dimensions [99]. A shorter and easier-to-use questionnaire designed to measure the same dimensions was developed by Lawler, Mohrman, and Cummings (see Instrument 16) [98].

Research on computers in settings outside of healthcare has frequently focused on changes in these job dimensions (e.g., word processing [100]). In some studies, computerization has been accompanied by attempts at work redesign specifically intended to create enriched jobs high on each of the five dimensions. Other studies simply measure whether the implementation of computers has had an impact on the dimensions of workers' jobs.

Griffin studied the long-term effects of computerization and work redesign on the jobs of tellers in 38 member banks of a large bank holding corporation [101]. Survey data were collected at four time periods: prior to implementation, 6 months after implementation, 24 months after implementation, and 48 months after implementation. Results showed different patterns for the different measures, underscoring the importance of evaluating the impacts of computerization and job changes at multiple points in time. Job satisfaction, for example, increased between Time 1 and Time 2, but returned to levels similar to Time 1 at Times 3 and 4. Individuals also perceived changes in their jobs (i.e., changes in task variety, autonomy, feedback, significance, and identity) at Time 2 and these perceptions did not diminish over the study period. Performance scores also followed a different pattern, showing no significant increase until Time 3 and maintaining that level at Time 4.

In the healthcare arena, the emphasis on cost efficacy and the need to streamline work processes and retain highly trained employees resulted in a renewed interest in job-design issues. Evaluating the impact of computerization on the skills of healthcare workers, however, must also consider existing job content. With the exception of some clerical workers and other particularly routine jobs, many healthcare occupations involve highly varied

and skilled work. For these individuals, using a computer comprises one task in a workday filled with diverse tasks. Although healthcare professionals sometimes voice resentment at being required to take time away from patient care to learn to use a computer system (e.g., Aydin and Rice [10,23]), deskilling or routinization is not usually an issue.

Research on computerization in healthcare settings has, however, addressed the issue of job redesign, using the measures described above [27,96]. Neither study, however, showed that computerization had an impact on the core job dimensions of the employees under study. Further research on job dimensions in healthcare settings should probably focus on employees for whom using the computer constitutes a major part of their job. In the Rice and Aydin study, in particular, computer use constituted only one task in the busy workday of most employees [27]. Kaplan and Duchon, however, also suggest that the lack of findings related to core job dimensions may reflect the fact that standard job characteristic measures do not take into account differences in how individuals holding ostensibly the same jobs actually view their work [96].

## Work Environment

The quality of the work environment focuses on broader and more evaluative responses to work, going beyond the specific dimensions examined under job enhancement to include issues such as general job satisfaction, job stress, time pressures, and the like [5]. Research results in general do indicate that computing may increase stress and time pressure for some workers. In most studies, however, results show that computing has increased workers' job satisfaction and interest in their work. Karasek and Theorell provide a detailed analysis of job-design issues and their relationship to the health and well-being of individual workers [102].

In an example of comprehensive longitudinal research on the impacts of computerization, Kraut, Dumais, and Koch investigated the specific job dimensions described above, as well as the overall impact of computerization on the work lives of customer service representatives in a large public utility [103]. Results showed that computerization can have complex and profound effects on job effectiveness and employment.

The information system investigated by Kraut et al. was designed to provide recent billing information and to allow interactive updating of customers' accounts, but no intentional attempt was made to redesign jobs or to alter the range of tasks or the interactions with customers [103]. (Similar systems are in use in billing departments in healthcare institutions.) Along with the introduction of the computer system, however, other changes were made that altered the office layout, disrupting familiar seating arrangements and changing the social organization of the department. Overall, results showed that the service representatives liked their jobs less after computerization. Contact with work colleagues became less frequent and

less satisfying, but there was also less job pressure and service representatives believed their overall workload had been reduced. Workers also modified the technology by finding innovative ways to use the new system as well as ways to use the system for clandestine note-passing strongly discouraged by supervisors.

Kaplan and Duchon [42,96] with their study of the laboratory computer system; Counte et al. [31,56] studying clerical employees involved in the admission, discharge, and transfer of patients; and Aydin and Rice [10,23] with their study of computerization in a student health clinic, have all conducted comprehensive longitudinal studies aimed at uncovering changes in the work life of healthcare workers following the implementation of a new computer system. (See Chapter 15 in this book and references [11] and [69].) Results of each study reflect both the approach taken by the investigators and actual impacts of computerization in the specific healthcare context.

Counte et al., for example, focused on individual differences to explain reactions of employees to computerization [31,56]. Long-term results indicated that both personality traits and attitudes toward computers were important predictors of individual reactions. Results of studies by both Kaplan and Duchon and Aydin and Rice focused on work group issues as well as individual differences in predicting adaptation to computerization [10,23,42,96]. Findings showed that, although employees cited both additional work and improvements in quality following computerization, departmental membership was an important predictor of individual reactions. In the laboratory, Kaplan and Duchon found that technologists in some laboratories focused on work increases, whereas in other laboratories they emphasized improved information flow [42,95,96]. In the student health clinic, Aydin and Rice found that attitudes toward the computer system and new communication with other departments about the system varied both by department and by occupation [10,23]. One of the most important predictors was the way in which work was organized within the individual departments and the negotiated assignment of the new tasks that accompanied computerization. In comprehensive studies such as these, general job satisfaction surveys can supplement the measures already described in providing important information on employee reactions to change (see Instrument 17). Another approach to the some of the same concepts can be found in the organizational culture literature, with Scott et al. providing a review of the available instruments to measure organizational culture in healthcare [104].

## Summary

In summary, the survey methods described in this chapter comprise an essential dimension in a multimethod approach to evaluating the impacts of computers on the functioning of healthcare organizations and the work

life of the individuals within them. The chapter and the instruments included in the chapter appendix should provide investigators with standardized instruments, as well as guidance and examples for questionnaire design where no standardized measure exists. Although not intended as a complete review of the literature, this chapter also provides investigators with an overview of topics to consider when planning any investigation of the social impacts of computers in healthcare organizations.

## *Additional Readings*

### Introduction

The references listed below were included as Additional Readings in the first edition of this book and remain valuable resources for survey research concepts and instruments for assessing the social impacts of computers in healthcare organizations. In addition, the website www.isworld.org/surveyinstruments/surveyinstruments.htm also provides researchers with a repository of actual survey instruments used in information systems, either in full text or via links or citations.

### Organizational Change and Information Systems

Markus provides an excellent analysis of the changes that occur in organizations with the introduction of information systems [1].

### Survey Research

See Kraemer for a collection of detailed reviews and discussions of survey methods in information systems research [7]. This volume also includes Zmud and Boynton's archive of over 100 instruments (although the scales themselves are not included) and Kraemer and Dutton's assessment of survey research in management information systems as well as other references on topics discussed throughout this chapter [6,8]. Cook, Hepworth, Wall, and Warr review nearly 250 scales for measuring work attitudes, values, and perceptions and include the most widely used instruments in their entirety [32].

### User Reactions and Characteristics of Individual Users

Kraemer—see above review [7].

Nelson reviews the literature on individual reactions to systems and suggests a framework that includes additional measures such as job satisfaction, organizational commitment, involvement, and performance [105].

Alavi and Joachimsthaler's meta-analysis of the information systems literature provides important information on the relative importance of different variables with suggestions for future research [51].

**Social Impacts of Computers**

Kraemer and Danziger provide a framework for the social impacts of computers and review the results of research [5].

Cummings and Huse is an excellent organization development textbook that addresses many of the organizational change issues involved in the implementation of an information system [98].

Hendrickson and Kovner review the literature and make recommendations for future research [86].

Karasek and Theorell provide a detailed analysis of job design issues and their relationship to the health and well-being of individual workers [102].

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# APPENDIX: SURVEY INSTRUMENTS

## SURVEY INSTRUMENTS

1. Short-Form Measure of User Information Satisfaction
2. End-User Computing Satisfaction
3. Implementation Attitudes Questionnaire
4. Organizational Information Technology/Systems Innovation Readiness Scale (OITIRS)
5. Point of Care Technology
6. Scales Adapted from Survey of Organizations
7. Examples of Short Global User Satisfaction Measures
8. Instruments to Assess Employee Adaptation
9. Patient Survey
10. Laboratory Computer Impact Study
11. WatchChild Obstetrical System Pre-Implementation Survey
12. WatchChild Obstetrical System Post-Implementation Survey
13. Work Role Activities
14. Network Survey
15. Communication Between Departments
16. Job Design Questionnaire
17. Job Satisfaction

### *1. Short-Form Measure of User Information Satisfaction*

The purpose of this study is to measure how *you* feel about certain aspects of the computer-based information products and services that are provided to you in your present position.

On the following pages you will find different factors, each related to some aspect of your computer-based support.[a] You are to rate each factor on the descriptive scales that follow it, based on your evaluation of the factor.

The scale positions are defined as follows:

adjective X:___:___:___:___:___:___: ___:adjective Y
(1) (2) (3) (4) (5) (6) (7)

(1) Extremely X
(2) Quite X
(3) Slightly X
(4) Neither X or Y; Equally X or Y; Does not apply
(5) Slightly Y
(6) Quite Y
(7) Extremely Y

The following example illustrates the scale positions and their meanings:
My vacation in the Bahamas was:restful:___:___:___:___ :___:___:_X_:hectic
healthy:_X_:___:___:___ :___:___::unhealthy

According to the responses, the person's vacation was extremely hectic and quite healthy.

**Instructions**

1. Check each scale in the position that describes your evaluation of the factor being judged.
2. Check every scale; do not omit any.
3. Check only one position for each scale.
4. Check in the space, not between spaces.

This Not this
:_X_: :___X___:

5. Work rapidly. Rely on your first impressions.

Thank you very much for your cooperation.

Answer based on your own feelings:

1. Relationship with the EDP[a] staff

dissonant:___:___:___:___:___:___:___:harmonious
bad:___:___:___:___:___:___:___:good

2. Processing of requests for changes to existing systems

fast:___:___:___:___:___:___:___:slow
untimely:___:___:___:___:___:___:___:timely

3. Degree of EDP training provided to users

complete:___:___:___:___:___:___:___:incomplete
low:___:___:___:___:___:___:___:high

4. Users' understanding of systems

insufficient:___:___:___:___:___:___:___:sufficient
complete:___:___:___:___:___:___:___:incomplete

5. Users' feelings of participation

positive:___:___:___:___:___:___:___:negative
insufficient:___:___:___:___:___:___:___:sufficient

6. Attitude of the EDP staff

cooperative:___:___:___:___:___:___:___:belligerent
negative:___:___:___:___:___:___:___:positive

7. Reliability of output information

high:___:___:___:___:___:___:___:low
superior:___:___:___:___:___:___:___:inferior

8. Relevancy of output information (to intended function)

useful:___:___:___:___:___:___:___:useless
relevant:___:___:___:___:___:___:___:irrelevant

9. Accuracy of output information

inaccurate:___:___:___:___:___:___:___:accurate
low:___:___:___:___:___:___:___:high

10. Precision of output information

low:___:___:___:___:___:___:___:high
definite:___:___:___:___:___:___:___:uncertain

11. Communication with EDP staff

dissonant:___:___:___:___:___:___:___:harmonious
destructive:___:___:___:___:___:___:___:productive

12. Time required for new systems development

unreasonable:___:___:___:___:___:___:___:reasonable
acceptable:___:___:___:___:___:___:___:unacceptable

13. Completeness of output information

sufficient:___:___:___:___:___:___:___:insufficient
adequate:___:___:___:___:___:___:___:inadequate

**Scoring**

The values for each item range from –3 to +3 with 0 indicating neutrality. Each scale is scored by taking the average of the two items. (Some items

are reverse scored to prevent respondents from marking down one column of the questionnaire.) The total score is determined by summing the scores on the 13 scales. Three subtotals (information product, EDP staff and services, and knowledge/involvement) are the averages of their component scales. The total score can range from +39 to –39 and the subtotals from +3 to –3. All of the reliabilities (Cronbach's alpha) are above .80 and the total score has a reliability of .89.

[a]*Note*: Computer-based support includes the following: in-house computer, timesharing, service bureau, access to a remote computer, use of computer-generated reports.

*Source*: Reprinted with permission from J.J. Baroudi, and W.J. Orlikowski. A short-form measure of user information satisfaction: A psychometric evaluation and notes on use, Journal of Management Information Systems 4 (1988) 44–59.

## 2. *End-User Computing Satisfaction*

**Scale**

1 = Almost never
2 = Some of the time
3 = Almost half of the time
4 = Most of the time
5 = Almost always

The 12-item End-User Computing Satisfaction measure includes the following five components (Cronbach's Alpha for the 12-item scale = .92):

*Factor 1: CONTENT* (coefficient alpha = .89)
- C1: Does the system provide the precise information you need?
- C2: Does the information content meet your needs?
- C3: Does the system provide reports that seem to be just about exactly what you need?
- C4: Does the system provide sufficient information?

*Factor 2: ACCURACY* (coefficient alpha = .91)
- A1: Is the system accurate?
- A2: Are you satisfied with the accuracy of the system?

*Factor 3: FORMAT* (coefficient alpha = .78)
- F1: Do you think the output is presented in a useful format?
- F2: Is the information clear?

*Factor 4: EASE OF USE* (coefficient alpha = .85)
- E1: Is the system user-friendly?
- E2: Is the system easy to use?

*Factor 5: TIMELINESS* (coefficient alpha = .82)
T1: Do you get the information you need in time?
T2: Does the system provide up-to-date information?

*Source*: Adapted from W.J. Doll, and G. Torkzadeh. The measurement of end-user computing satisfaction, MIS Quarterly 12 (1988) 259–274.

## 3. Implementation Attitudes Questionnaire

You are asked to read each statement carefully and to circle one of the words from each following line that describes most clearly how you feel about the statement. For example:

I find the computer system interesting.

| Strongly disagree | Disagree | Uncertain | Agree | Strongly agree |
|---|---|---|---|---|
| | | | X | |

This would indicate that you agree with the statement.

Please keep in mind that what is important is your own opinion. The computer system is presently being considered for implementation. Remember, this questionnaire is asking for *your opinion about the computer system*.

Each item implies "after the implementation," that is, this questionnaire is concerned with how you feel about each statement as it applies to the situation *after the computer system is operational*.

Each item implies that changes will occur *after the computer system is in use*. For example, the statement

"My job will be more satisfying."

implies

"My job will be more satisfying "*after the computer system is in use*."

*Note*: The original questionnaire included 67 items. The items listed below were interpretable in 7 factors. An additional 10 items did not load significantly on a factor or were not interpretable.

**Factor List**

*Factor 1: PERFORMANCE—Effect on Job Performance and Performance Visibility*
My job will be more satisfying.
Others will better see the results of my efforts. It will be easier to perform my job well.

The accuracy of information I receive will be improved by the computer system.
I will have more control over my job.
I will be able to improve my performance.
Others will be more aware of what I am doing.
The information I will receive from the computer system will make my job easier.
I will spend less time looking for information.
I will be able to see better the results of my efforts.
The accuracy of my forecast will improve as a result of using the computer system.
My performance will be more closely monitored.
The division/department will perform better.

*Factor 2: INTERPERSONAL—Interpersonal Relations, Communication, and Increased Interaction and Consultation with Others*

I will need to communicate with others more.
I will need the help of others more.
I will need to consult others more often before making a decision.
I will need to talk with other people more.
I will need the help of others more.

*Factor 3: CHANGES—Changes Will Occur in Organizational Structure and People I Deal With*

The individuals I work with will change.
The management structure will be changed.
The computer system will not require any changes in division/department structure.
I will have to get to know several new people.

*Factor 4: GOALS—Goals Will Be More Clear, More Congruent to Workers, and More Achievable*

Individuals will set higher targets for performance.
The use of the computer system will increase profits.
This project is technically sound.
Company goals will become more clear.
My counterparts in other divisions/departments will identify more with the organization's goals.
The patterns of communication will be more simplified.
My goals and the company's goals will be more similar than they are now.
The aims of my counterparts in other divisions/departments will be more easily achieved.
My personal goals will be better reconciled with the company's goals.

*Factor 5: SUPPORT/RESISTANCE—Computer System Has Implementation Support—Adequate Top Management, Technical, and Organizational Support—and Does Not Have Undue Resistance*

Top management will provide the resources to implement the computer system.

People will accept the required change.
Top management sees the computer system as being important.
Implementing the computer system will be difficult.
Top management does not realize how complex this change is.
People will be given sufficient training to utilize the computer system.
This project is important to top management.
There will be adequate staff available to successfully implement the computer system.
My counterparts in other divisions/departments are generally resistant to changes of this type.
Personal conflicts will not increase as a result of the computer system.
The developers of the computer system will provide adequate training to users.

*Factor 6: CLIENT—System Developers Understand the Problems and Work Well with Their Clients*

The developers of these techniques don't understand our problems.
I enjoy working with those who are implementing the computer system.
When I talk to those implementing the computer system, they respect my opinions.

*Factor 7: URGENCY—Need for Results, Even with Costs Involved; Importance to Me, Boss, Top Management*

The computer system costs too much.
I will be supported by my boss if I decide not to use this model.
Decisions based on the computer system will be better.
The results of the computer system are needed now.
The computer system is important to me.
I need the computer system.
It is important that the computer system be used soon.
This project is important to my boss.
The computer system should be put into use immediately.
It is urgent that the computer system be implemented.
The sooner the computer system is in use the better.
Benefits will outweigh the costs.

**Dependent Variables**

1. Please circle the number on the scale below that indicates the probability that you will use the computer system.

   0. .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

2. Please circle the number on the scale below that indicates the probability that others will use the computer system.

   0. .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

3. Please circle the number on the scale below that indicates the probability that the computer system will be a success.

   0. .1 .2 .3 .4 .5 .6 .7 .8 .9 1.0

4. On the 10-point scale below indicate your evaluation of the worth of the computer system.

   Not useful at all — Moderately useful — Excellent
   1 2 3 4 5 6 7 8 9 10

5. Please circle the number on the scale below that indicates the level of accuracy you expect from the computer system.

   Not useful at all — Moderately useful — Excellent
   1 2 3 4 5 6 7 8 9 10

*Source*: Adapted from R.L. Schultz, and D.P. Slevin. Implementation and organizational validity: An empirical investigation, in: R.L. Schultz and D.P. Slevin, editors, *Implementing Operations Research/Management Science*. (American Elsevier, New York, 1975) 153–182. Scales were determined by factor analysis. (Used by permission.)

## *4. Organizational Information Technology/Systems Innovation Readiness Scale (OITIRS)*

**Directions**: Listed below are a series of statements about the *readiness* of your organization to implement the _____ **(insert name of IT/S innovation)**. For each statement, please *circle* the number of the *one* response that *best reflects* your personal opinion. A **"*no opinion*"** option is provided for those statements about which you have limited information. Thank you for responding to each statement.

**KEY: SD** = Strongly Disagree **SA** = Strongly Agree **NO** = No Opinion

| **In this organization:** | **SD** | | | **NO** | | | **SA** |
|---|---|---|---|---|---|---|---|
| 1. Funding is adequate for completion of IT/S innovation implementation. | 1 | 2 | 3 | 4 | 5 | 6 | 7 8 |
| 2. Project teams have included both technical support staff and users. | 1 | 2 | 3 | 4 | 5 | 6 | 7 8 |
| 3. The project budget includes training/retraining costs. | 1 | 2 | 3 | 4 | 5 | 6 | 7 8 |
| 4. The project budget is consistent with the organization's strategic plan. | 1 | 2 | 3 | 4 | 5 | 6 | 7 8 |
| 5. There is a good ratio of full-time in-house to contract IS staff to support the project. | 1 | 2 | 3 | 4 | 5 | 6 | 7 8 |

| | |
|---|---|
| 6. Good quality vendor support for the IT/S innovation is typically available. | 1 2 3 4 5 6 7 8 |
| 7. Most users have an adequate level of computer literacy. | 1 2 3 4 5 6 7 8 |
| 8. Users are typically supportive of IT/S innovation. | 1 2 3 4 5 6 7 8 |
| 9. User competencies are appropriately incorporated into job performance criteria. | 1 2 3 4 5 6 7 8 |
| 10. Users are typically involved in IT/S projects. | 1 2 3 4 5 6 7 8 |
| 11. Adequate training is available to support users. | 1 2 3 4 5 6 7 8 |
| 12. A core group of users is available to support implementation. | 1 2 3 4 5 6 7 8 |
| 13. Current work practices are adequately supported by existing information systems. | 1 2 3 4 5 6 7 8 |
| 14. There is a good fit between organizational and IS strategic plans. | 1 2 3 4 5 6 7 8 |
| 15. Research and development activities to learn about new technology are supported. | 1 2 3 4 5 6 7 8 |
| 16. IT/S project implementation time frames are usually adequate. | 1 2 3 4 5 6 7 8 |
| **In this organization:** | **SD NO SA** |
| 17. Development of information systems is based on current market trends. | 1 2 3 4 5 6 7 8 |
| 18. There are good quality vendor contracts. | 1 2 3 4 5 6 7 8 |
| 19. There is a lot of knowledge about IS operational and capital budget trends. | 1 2 3 4 5 6 7 8 |
| 20. Historically, the strategic and IS goals have been integrated. | 1 2 3 4 5 6 7 8 |
| 21. In the past, IS staff have been included in decision-making processes. | 1 2 3 4 5 6 7 8 |
| 22. Administrators are very knowledgeable about IT/S innovation based on their past experience. | 1 2 3 4 5 6 7 8 |
| 23. There is a lot of knowledge about the ongoing development needs of IS support staff. | 1 2 3 4 5 6 7 8 |
| 24. Knowledge is available about how IT/S innovations are being used by other organizations. | 1 2 3 4 5 6 7 8 |
| 25. Adequate communication mechanisms exist to support shared communication across all organizational levels. | 1 2 3 4 5 6 7 8 |
| 26. Effective mechanisms are in place to evaluate IT/S innovations. | 1 2 3 4 5 6 7 8 |
| 27. The most appropriate individuals are involved in the development of the IS strategic plan. | 1 2 3 4 5 6 7 8 |

| | | |
|---|---|---|
| 28. | IS needs are routinely incorporated into the organization's business processes. | 1 2 3 4 5 6 7 8 |
| 29. | Process improvement mechanisms are used effectively to identify work process redesign needs. | 1 2 3 4 5 6 7 8 |
| 30. | IS decision makers are adequately represented on key organizational committees. | 1 2 3 4 5 6 7 8 |
| 31. | There is a willingness to act on work process improvement recommendations. | 1 2 3 4 5 6 7 8 |
| 32. | There is satisfaction with the contribution that IS has made to the organization. | 1 2 3 4 5 6 7 8 |
| 33. | There is an openness to different perspectives about IS. | 1 2 3 4 5 6 7 8 |
| 34. | There is an emphasis on the importance of collaborative interdisciplinary teams to support IT/S innovation. | 1 2 3 4 5 6 7 8 |

| **In this organization:** | | **SD NO SA** |
|---|---|---|
| 35. | There is a willingness to engage in the IT/S innovationprocess. | 1 2 3 4 5 6 7 8 |
| 36. | Individuals have a positive attitude toward IT/S innovation. | 1 2 3 4 5 6 7 8 |
| 37. | The business structure supports involvement of IS in strategic planning. | 1 2 3 4 5 6 7 8 |
| 38. | Formal communication mechanisms exist to support user and IS support staff communication. | 1 2 3 4 5 6 7 8 |
| 39. | The IS department reporting structure adequately supports IS staff. | 1 2 3 4 5 6 7 8 |
| 40. | The IS strategic plan is an effective guide for the organization's IT/S innovation processes. | 1 2 3 4 5 6 7 8 |
| 41. | The IS department effectively manages the organization's shared databases. | 1 2 3 4 5 6 7 8 |
| 42. | Formal policies and procedures are available to guide IS processes. | 1 2 3 4 5 6 7 8 |
| 43. | IS initiatives are usually addressed as part of the organization's overall strategic planning. | 1 2 3 4 5 6 7 8 |
| 44. | Board members are actively engaged in key IS committees. | 1 2 3 4 5 6 7 8 |
| 45. | Sufficient funds are available to support IS planning activities. | 1 2 3 4 5 6 7 8 |
| 46. | The top-ranking IS executive is regularly included in senior executive meetings. | 1 2 3 4 5 6 7 8 |
| 47. | Non-IS executives are routinely named as co-sponsors for IS projects. | 1 2 3 4 5 6 7 8 |

48. Executives engage in mutual decision making with IS leaders regarding proposals and ideas. 1 2 3 4 5 6 7 8

Printed with permission from Rita Snyder-Halpern. Reliability for the 48-item subscale: Cronbach's alpha coefficients of .83 (resources), .79 (end-users), .84 (technology), .83 (knowledge), .79 (processes), .84 (values and goals), .80 (management structures), and .87 (administrative support).

*Source*: R. Snyder-Halpern, Development and pilot testing of an Organizational Information Technology/Systems Innovation Readiness Scale (OITIRS), in: *Proceedings of the AMIA 2002 Annual Symposium*, Washington DC (2002), pp. 702–706.

## *5. Point of Care Technology*

What do you think? Please complete this questionnaire:

SECTION A: Your Views About Using the Point of Care System

In the following section you will be presented with a number of statements expressing different viewpoints about the *point of care system*.

Circle the number that indicates how much each statement reflects *your personal* viewpoint.

Example survey setup for each question:

Using the point of care system would enable me to accomplish tasks more quickly.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Strongly disagree | | | Neither agree nor disagree | | | Strongly agree |

*Note*: Questions 3, 8, 17, 18, 30, 33–38, 42, 43, 47, and 48 are answered on the following scale:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Extremely unlikely | | | Neither likely nor unlikely | | | Extremely likely |

1. Using the point of care system would enable me to accomplish tasks more quickly.
2. It would be easy to get the point of care system to do what I want it to do.
3. If the decision were totally up to me, I would decide to start using the point of care system in the future.
4. Using the point of care system would enable my work to be more controlled by others.

5. Using the point of care system would fit well with the way I like to work.
6. Using the point of care system would result in many aspects of my job becoming more repetitive and boring.
7. I would have no difficulty telling others about the results of using the point of care system.
8. I intend to use the point of care system frequently.
9. Using the point of care system would enable my job performance to be more closely monitored by others.
10. Nursing staff in my hospital who use the point of care system would have a high profile.
11. I would be able to communicate to others the consequences of using the point of care system.
12. My interaction with the point of care system would be clear and understandable.
13. Using the point of care system may adversely affect my health.
14. Using the point of care system would improve the quality of work I do.
15. Nursing staff in my hospital who use the point of care system would have more prestige than those who do not.
16. Although it may be helpful, using the point of care system would certainly *not* be compulsory in my job.
17. I intend to be a heavy user of the point of care system.
18. I would feel very positive about using the point of care system.
19. Introduction of the point of care system in my hospital may eventually result in the elimination of my job.
20. Learning to operate the point of care system would be easy for me.
21. Using the point of care system would enhance my effectiveness on the job.
22. The results of using the point of care system would be apparent to me.
23. Using the point of care system would fit into my work style.
24. I would have difficulty explaining why using the point of care system may or may not be beneficial.
25. Using the point of care system would give me greater control over my work.
26. Using the point of care system would be a status symbol in my hospital.
27. Using the point of care system would be completely compatible with my current situation.
28. Using the point of care system would unrealistically raise others' expectations about the amount of work that I can accomplish.
29. Overall, the point of care system would be easy for me to use.
30. My Nursing Manager would not require me to use the point of care system.
31. Using the point of care system would make it easier to do my job.
32. One final question in this section:

When I am faced with a task or decision of the sort that the point of care system is designed to support, I intend to use the system. . . .
___ % of the time.

Indicate a number between 0 and 100 where:
0 = I don't intend to use the system at all.
100 = I intend to use the system each and every time that I am faced with a task or decision of the sort that the system is designed to support.

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SECTION B: Questions About Yourself

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For each of the following statements, please circle the number that indicates how likely or unlikely each of the statements are. Note that you are being asked *how likely the statements are*, not whether you have discussed the topics. Remember that your *individual* opinions are important.

33. My *co-workers* think that I should use the point of care system in my job.
34. My *Nursing Manager* thinks that I should use the point of care system in my job.
35. My *Director of Nursing* thinks that I should use the point of care system in my job.
36. With respect to the Nursing Unit, I want to do what my *co-workers* think I should do.
37. With respect to the Nursing Unit, I want to do what my *Nursing Manager* thinks I should do.
38. With respect to the Nursing Unit, I want to do what my *Director of Nursing* thinks I should do.

In the following questions please circle the number that best indicates your response.

39. Does your *collective bargaining unit* (union) have any official position with respect to the use of information technology in the workplace? (Circle number)

    Yes . . . . . Go to Question 40
    No . . . . . Go to Question 41
    Don't Know . . . . . Go to Question 41

40. Do you think this *official position* is in favor of, or against, the use of information technology?
41. In general, how do you feel the *general membership* of your union view the use of information technology?
42. In general, how likely are you to follow or support *your union's* official policies?
43. In general, how likely are you to follow or support the *general membership's* viewpoints?

44. Does your *professional association* have any official position with respect to the use of information technology in the workplace? (Circle number)

    Yes . . . . . Go to Question 45
    No . . . . . Go to Question 46
    Don't Know . . . . . Go to Question 46

45. Do you think this *official position* is in favor of, or against, the use of information technology?
46. In general, how do you feel the *general membership* of your professional association view the use of information technology?
47. In general, how likely are you to follow or support *your professional association's* official policies?
48. In general, how likely are you to follow or support the *general membership's* viewpoints?

Printed with permission. Three attitude factors (compatibility, relative advantage, and result demonstrability) and one subjective norm factor (Director of Nursing) were the strongest predictors of intent to use the point of care technology. "A score for subjective norm was calculated by multiplying the response to normative belief held by referents (i.e., "the degree to which [referent X] thinks I should use a bedside terminal") by the motivation to comply with that particular referent (i.e., "Generally speaking, I want to do what [referent X] thinks I should do")." (p. 377).

*Source*: M Hebert, and I. Benbasat. Adopting information technology in hospitals: The relationship between attitudes/expectations and behavior, Hospital and Health Services Administration 39 (1994) 369–383.

## 6. Scales Adapted from Survey of Organizations

This section asks about learning to use the system. Use the following codes to indicate your response:

1 = Strongly disagree
2 = Disagree
3 = Slightly disagree
4 = Neutral
5 = Slightly agree
6 = Agree
7 = Strongly agree

Please indicate the extent to which you agree with the following statements:

1. I attend regular meetings where we talk about how to use the system. 1 2 3 4 5 6 7
2. Organizational policies generally discourage me from developing new procedures or uses of the system 1 2 3 4 5 6 7

| | |
|---|---|
| 3. I receive praise for developing new ways to use the system to accomplish my job or to solve problems using the system: | |
| —from my supervisor | 1 2 3 4 5 6 7 |
| —from my co-workers | 1 2 3 4 5 6 7 |
| 4. I generally do not have time to learn or experiment with possible new procedures or uses of the system. | 1 2 3 4 5 6 7 |
| 5. My co-workers and/or I develop new procedures or uses of the system. | 1 2 3 4 5 6 7 |
| 6. Other people do not generally encourage me to experiment with new procedures or uses of the system. | 1 2 3 4 5 6 7 |
| 7. I talk about ways to use the system to accomplish my job or solve problems: | |
| —with my supervisor | 1 2 3 4 5 6 7 |
| —with my co-workers | 1 2 3 4 5 6 7 |

*Note*: The variables were interpretable in 2 factors. Questions 1, 3, 5, and 7 comprise Factor 1—Work Group Communication About the Computer. Questions 2, 4, and 6 comprise Factor 2—Organizational Support for Implementation. Cronbach's coefficient alpha for Factor 1 when the variables were added = .88; Factor 2 = .61. See Aydin and Rice (references [10] and [23]) for details.

*Source*: Adapted from J.C. Taylor and D.G. Bowers. *Survey of Organizations: A Machine Scored Standardized Questionnaire Instrument*. (Institute for Social Research, University of Michigan, Ann Arbor, 1972).

## *7. Examples of Short Global User Satisfaction Measures*

**Single-Item Measure**

Use the following codes to indicate your response:

1 = Strongly disagree
2 = Disagree
3 = Slightly disagree
4 = Neutral
5 = Slightly agree
6 = Agree
7 = Strongly agree

How much do you agree with the following statement about the system?

The new computer system is worth the time and effort required to use it. 1 2 3 4 5 6 7

Use the following code to indicate your response:

1 = Significantly decreased
2 = Decreased
3 = Slightly decreased
4 = No change, no opinion
5 = Slightly increased
6 = Increased
7 = Significantly increased

Overall, to what extent has the system changed these two aspects of *your own* department?

| | |
|---|---|
| Ease of performing our department's work | 1 2 3 4 5 6 7 |
| Quality of our department's work | 1 2 3 4 5 6 7 |

*Note*: Single-item measure test-retest reliability on same questionnaire in different context is .73. Cronbach's alpha for three items combined is .83.

*Source*: C.E. Aydin and R.E. Rice. Social worlds, individual differences, and implementation: Predicting attitudes toward a medical information system, Information and Management 20 (1991) 119–136.

## *8. Instruments to Assess Employee Adaptation*

**Use Scale**

How frequently have you had problems with the MIS since implementation?

1. All day long every day
2. Several times a day
3. About once a day
4. Several times a week
5. Once a week or less

If you could do away with the MIS and go back to the old way of doing things, would you?

1. Yes
2. No

How frequently do you find it necessary to bypass the MIS and use the old way of doing things?

1. All day long every day
2. Several times a day
3. About once a day
4. Several times a week
5. Once a week or less

How frequently do you feel like hitting the MIS terminal or breaking a light pen?

1. All day long every day
2. Several times a day

3. About once a day
4. Several times a week
5. Once a week or less
6. Never

**Change Scale**

How has the MIS changed your job?
This MIS has made my job:

| | | | |
|---|---|---|---|
| more difficult | 1 | . . . . . | 7 easier |
| more interesting | 1 | . . . . . | 7 less interesting |
| less stressful | 1 | . . . . . | 7 more stressful |
| more fun | 1 | . . . . . | 7 less fun |
| more pleasant | 1 | . . . . . | 7 less pleasant |

**Behavioral Scale**

Please rate the frequency with which this employee has exhibited the following behaviors with regard to the MIS (1 = never, 2 = occasionally, 3 = fairly frequently, 4 = very frequently):

1. Praising the MIS
2. Difficulty learning to use the MIS
3. Very cooperative with MIS personnel
4. Complaining about the MIS
5. A high level of proficiency learning to use the MIS
6. Lack of cooperation with the MIS personnel
7. Improved work performance
8. Increased absenteeism or tardiness
9. Using the MIS appropriately
10. Slowing work performance
11. Enjoying working on the MIS
12. Bypassing the MIS (i.e., using pre-MIS procedures to do things)

**Scoring**

*Use Scale:* Responses to the items were summed to derive a total score. Cronbach alpha was .79.

*Change Scale:* Responses to items 2 through 5 were reversed and then the five items were summed to derive a total change score. Cronbach alpha was .82.

*Behavioral Scale:* All of the negative items are reversed and a total score computed. Cronbach Alpha was .80.

*Source*: K.H. Kjerulff, M.A. Counte, J.S. Salloway, and B.C. Campbell. Understanding employee reactions to a medical information system, in:

*Proceedings of the Fifth Annual Symposium on Computer Applications in Medical Care*, Los Angeles, CA, IEEE Computer Society Press (1981), pp. 802–805.

## *9. Patient Survey*

The Department of Preventive Medicine (Health Appraisal Clinic) is continually striving to meet your expectations for excellence in quality of care and service. You can help us understand how we might do better by filling out this survey. The following questions are designed to focus our attention on areas of concern to you. Questions concerning computers are included to help us determine how they may add or detract from the quality of the examination. Videotaping examinations allows us to learn about interactions during the exam that patient surveys and interviews alone cannot. The results of the survey will be confidential and anonymous. Thank you for helping us improve our service to you.

Please complete the survey by answering the following questions:

Age___ Sex M___F___ Length membership___ years
Do you have a regular doctor? ___Yes ___No
Highest education level: 6–12___ college___ postgrad___
Income level: ___under $20,000 ___under $50,000 ___greater than $50,000
I use a computer at home and/or work. Yes___ No___

Please answer the following questions by placing a circle around the number that most closely fits. For example, if you strongly disagree with the statement, circle #1. If you strongly agree, circle #5. If you fall somewhere in between, circle #2 or #3 or #4. We are asking for you opinion; there are no right or wrong answers. Feel free to give us your honest opinion.

| Strongly Disagree (1) | Disagree (2) | Neutral (3) | Agree (4) | Strongly Agree (5) |
|---|---|---|---|---|

1. I am satisfied with my visit to the Health Appraisal Clinic. 1 2 3 4 5
2. The staff of the Health Appraisal Clinic treat me with courtesy and respect. 1 2 3 4 5
3. The Health Appraisal Clinic is a valuable part of my membership in the Health Plan. 1 2 3 4 5
4. I am satisfied with the "multiphasic" (first half) portion of the examination. 1 2 3 4 5
5. I am satisfied with the physical examination (second half). 1 2 3 4 5
6. The Health Appraisal Clinic is one of the reasons I will renew my membership in the Health Plan. 1 2 3 4 5

| | | |
|---|---|---|
| 7. | The examiner seemed to care about my problems. | 1 2 3 4 5 |
| 8. | The examiner gave me a chance to really say what was on my mind. | 1 2 3 4 5 |
| 9. | I really felt understood by the examiner. | 1 2 3 4 5 |
| 10. | The examiner accepted me as a person. | 1 2 3 4 5 |
| 11. | The examiner relieved my anxiety. | 1 2 3 4 5 |
| 12. | The examiner paid attention to me. | 1 2 3 4 5 |
| 13. | The examiner's attention was focused on the chart/computer. | 1 2 3 4 5 |
| 14. | It was easy to talk to the examiner. | 1 2 3 4 5 |
| 15. | The examiner answered all of my questions. | 1 2 3 4 5 |
| 16. | I am confident with the results of the history and physical examinations. | 1 2 3 4 5 |
| 17. | The examiner explained my health status in words that I could understand. | 1 2 3 4 5 |
| 18. | The examiner is good at explaining the reasons for medical tests. | 1 2 3 4 5 |
| 19. | After talking with the examiner, I have a good understanding of my health status. | 1 2 3 4 5 |
| 20. | I understood the examiner's plan for follow-up of my health related status (if needed). | 1 2 3 4 5 |
| 21. | The examiner gave me a thorough examination. | 1 2 3 4 5 |
| 22. | The examiner looked into all the problems I mentioned. | 1 2 3 4 5 |
| 23. | I am confident with the abilities of the examiner. | 1 2 3 4 5 |
| 24. | The examiner spent enough time with me. | 1 2 3 4 5 |
| 25. | The examiner seemed rushed during his/her examination of me. | 1 2 3 4 5 |
| 26. | It will be easy to follow the advice of the examiner. | 1 2 3 4 5 |
| 27. | I will follow the advice of the examiner completely. | 1 2 3 4 5 |
| 28. | The advice the examiner gave me is very important. | 1 2 3 4 5 |
| 29. | If I follow all the advice, my health is likely to improve. | 1 2 3 4 5 |
| 30. | It is important for me to get well and stay well. | 1 2 3 4 5 |
| 31. | I trust computers. | 1 2 3 4 5 |
| 32. | Computers can make mistakes. | 1 2 3 4 5 |
| 33 | The examiner seemed to have trouble using the computer. | 1 2 3 4 5 |
| 34. | I think the computer helps the examiner take care of me. | 1 2 3 4 5 |
| 35 | If given a choice, I would choose an examiner who uses a computer. | 1 2 3 4 5 |

*Sources*: C.E. Aydin, J.G. Anderson, P.N. Rosen, V.J. Felitti, and H.C. Weng. Computers in the consulting room: Clinician and patient perspectives, Health Care Management Science 1 (1998) 61–74. Used with permission.

Survey items 7–14 (Affective Scale), 15–20 (Cognitive Scale), and 21–25 (Behavior Scale) were adapted from M.H. Wolf, S.M. Putnam, S.A. James, and W.B. Stiles. The medical interview satisfaction scale: Development of a scale to measure patient perceptions of physician behavior, Journal of Behavioral Medicine 1 (1978) 391–401. Items 7–12 and 14 were used as a 6-item scale. Item 13, the reversed item, did not scale with the others (i.e., after scoring was reversed the addition of this item to the scale reduced the Cronbach alpha coefficient significantly). Item 13 was used as a single item. Items 21–24 were used as 4-item scale. Item 25, the reversed item, did not scale with the others and was used as a single item. Items 26–30 (Acceptance of advice scale) were adapted from J. Kincey, P. Bradshaw, and P. Ley. Patients' satisfaction and reported acceptance of advice in general practice, Journal of the Royal College of General Practitioners 25 (1975) 558–566. Items 31–35 (Computer in exam room scale) were adapted from G. Brownbridge, E.J. Lilford, and S. Tindale-Biscoe. Use of a computer to take booking histories in a hospital antenatal clinic, Medical Care 26 (1988) 474–487. Items 31, 34–35 were used as 3-item scale. Items 32 and 33, the reversed items, did not scale with the others. Item 32 was not used; item 33 was used as a single item. Question 35 was also used as a single item in some analyses.

## *10. Laboratory Computer Impact Survey*

The next set of questions asks about how things have changed since the introduction of the laboratory computer system. Please base your answers on what it is like now, not on how it was when the computer system was installed. Please answer as best as you can, even if you weren't here when the computer was installed.

*External Communication* (coefficient alpha = .62; mean response = 3.37)

- The computer makes it easier to route samples to the appropriate laboratory.
- Computerized lab records aid communication between the lab and other personnel.
- The computer system improves the relationship between the labs and other medical personnel.

*Service Outcomes* (coefficient alpha = .84; mean response = 3.13)

- We provide better service because of the computer.
- We should have gotten a computer system a long time ago.
- The computer helps make the labs better managed.
- Overall, reports from my lab are more accurate now than before the computer was installed.
- Test reports are more accurate because they have to be entered into the computer.

Because of the computer there is better interpretive information provided with test reports.

*Personal Intentions* (coefficient alpha = .53; mean response = 4.30)

I plan to avoid using the computer system as much as possible. I

I plan to use the computer system as much as possible.

*Personal Hassles* (coefficient alpha = .86; mean response = 2.68)

The number of phone calls I answer has increased.

Since the computer was installed my work is more satisfying than it used to be. I

The computer makes it harder to meet all the demands placed on me.

Because of the computer I now have more work to do.

The computer has changed my job from being a technologist to being a clerk.

My responsibilities have increased because of the computer.

Our work is slowed down because we have to do data entry.

We have to find ways around the computer in order to get our work done.

*Increased Blame* (coefficient alpha = .87; mean response = 2.71)

People call the lab now with more problems and questions that I wish I didn't have to deal with.

Since the computer was installed people in the labs are getting blamed for problems that aren't really their fault.

Doctors and nurses complain to us more now that we have the computer.

We now do a lot of work CPA (specimen intake) did.

We get blamed for CPA's mistakes.

The computer people run the labs now.

Doctors and nurses cooperate with us less than they did before the computer.

I don't think doctors and nurses like the computer system.

The computer system causes ill will toward the labs.

*Response Scale:* Range from 1 to 5: 1 = Strongly disagree, 3 = Neutral, 5 = Strongly agree. I indicates reverse scoring.

*Note*: Questions concerning personal intentions were adapted from Kjerulff et al., Predicting employee adaptation to the implementation of a medical information system, in: *Proceedings of the Sixth Annual Symposium on Computer Applications in Medical Care*, Silver Springs, MD, IEEE Computer Society (1982), pp. 392–397.

*Source*: B. Kaplan and D. Duchon. A qualitative and quantitative investigation of a computer system's impact on work in clinical laboratories (unpublished manuscript) (1987); B. Kaplan and D. Duchon, A job orientation model of impact on work seven months post-implementation, in: *Proceedings of Medinfo 89: Sixth World Congress on Medical Informatics*, Amsterdam, North-Holland (1989), pp. 1051–1055.

# *11. WatchChild Obstetrical System Pre-Implementation Survey*


**Cedars-Sinai Medical Center**
**WatchChild Evaluation**
**December 1998**

This questionnaire asks you what you think it will be like using WatchChild as part of your job. You will be asked to answer the same questions again after you have had experience using the system. Your responses will help us evaluate how well WatchChild meets your needs. Your responses are anonymous and your opinions are important to us. *Please fill in the circle that indicates your response to each question. (Use blue or black ink or No. 2 pencil and darken the circle completely.)*

| | *Strongly Disageree* | | *Neutral or Uncertain* | | *Strongly Agree* |
|---|---|---|---|---|---|
| 1. WatchChild will be worth the time and effort required to use it. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 2. My job will be more satisfying. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 3. Others will better see the results of my efforts. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 4. It will be easier to perform my job well. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 5. The accuracy of iinformation I receive will be improved by WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 6. I will have more control over my job. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 7. I will be able to improve my performance. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 8. Others will be more aware of what I am doing. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 9. The information I receive from WatchChild will make my job easier. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 10. I will spend less time looking for information. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 11. I will be better able to see the results of my effort. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 12. The accuracy of my charting will improve as a result of using WatchChild | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 13. My performance will be more closely monitored. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 14. The Department will perform better. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 15. Top management will provide the resources to implement WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 16. People will accept the required changes. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 17. Top management sees the computer system as being important. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 18. Implementing WatchChild will be difficult. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 19. Top management does not realize how complex this change is. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 20. People will be given sufficient training to utilize WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 21. There will be adequate staff available to successfully implement WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 22. Personal conflicts will not increase as a result of WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 23. The developers of WatchChild will provide adequate training to users. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 24. We will provide better service because of WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 25. I plan to avoid using WatchChild as much as possible. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 26. I plan to use WatchChild as much as possible. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 27. WatchChild will make it harder to meet all the demands placed on me. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 28. Because of WatchChild I will have more work to do. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 29. My responsibilities will increase because of WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 30. My work will be slowed down because I will have to do data entry. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 31. I will have to find ways around WatchChild to get my work done. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 32. WatchChild will interfere with my relationships with my patients. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

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| | *Strongly Disagree* | | *Neutral or Uncertain* | | *Strongly Agree* |
|---|---|---|---|---|---|
| 33. Having WatchChild will improve patient satisfaction with care. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 34. I am confident that I will be able to learn to use WatchChild. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

| | *Almost never* | *Some of the time* | *Almost half of the time* | *Most of the time* | *Almost Always* |
|---|---|---|---|---|---|
| 35. I am satisfied with the accuracy of the WatchChild system. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 36. WatchChild output is presented in a clear and useful format. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 37. The information is clear. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 38. The system is user-friendly. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 39. The system is easy to use | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

40. How long have you worked in Women's Health at Cedars-Sinai? ○ 1 year or less ○ 2-5 years ○ More than 5 years

41. Please evaluate the WatchChild training you have received so far.

○ Poor ○ Fair ○ Good ○ Very Good ○ Excellent

Position ○ RN ○ MD ○ NCT ○ Other

Shift (Check only one) ○ Day ○ Night ○ Not Applicable

Primary Area: (RNs only) Check only one ○ Labor & Delivery ○ Triage ○ MFCU ○ Postpartum ○ Antepartum Testing ○ Generalist

Are you a WatchChild Superuser? ○ Yes ○ No

Comments:

For office use only

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# *12. WatchChild Obstetrical System Post-Implementation Survey*

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Cedars-Sinai Medical Center
WatchChild Evaluation
April 2000

This questionnaire asks you what it is like using WatchChild as part of your job. You were asked some of the same questions before you began using the system. Your responses help us evaluate how well WatchChild meets your needs. Your responses are anonymous and your opinions are important to us. *Please fill in the circle that indicates your response to each question. (Use blue or black ink or No. 2 pencil and darken the circle completely.)*

| | *Strongly Disagree* | | *Neutral or Uncertain* | | *Strongly Agree* |
|---|---|---|---|---|---|
| 1. WatchChild is worth the time and effort required to use it. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 2. Others now see the results or my efforts better. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 3. The information I receive from WatchChild makes my job easier. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 4. I avoid using WatchChild as much as possible. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 5. WatchChild makes it harder to meet all the demands placed on me. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 6. WatchChild interferes with my relationships with my patients. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

| | *Almost never* | *Some of the time* | *Almost half of the time* | *Most of the time* | *Almost Always* |
|---|---|---|---|---|---|
| 7. I am satisfied with the accuracy of the WatchChild system. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 8. WatchChild output is presented in a clear and useful format. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 9. The information is clear. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 10. The system is user-friendly. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |
| 11. The system is easy to use. | ○ 1 | ○ 2 | ○ 3 | ○ 4 | ○ 5 |

12. How long have you worked in Women's Health at Cedars-Sinai? ○ 1 year or less ○ 2-5 years ○ More than 5 years

Position ○ RN ○ MD ○ NCT ○ Other

Shift (Check only one) ○ Day ○ Night ○ Not Applicable

Primary Area: (RNs only) Check only one ○ Labor & Delivery ○ Triage ○ MFCU ○ Postpartum ○ Antepartum Testing ○ Generalist

Are you a WatchChild Superuser? ○ Yes ○ No

Comments:

For office use only

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

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WatchChild2 4/2000

*Sources*: C.E. Aydin, K. Gregory, L. Korst, J. Polaschek, and T. Chamorro. Panel: Making it happen: Organizational changes required to implement an electronic medical record in a large medical center, in: *AMIA'99 Annual Symposium*, Washington, DC (November 6–10, 1999). Reprinted with permission: K. Gregory, Cedars-Sinai Medical Center.

## *13. Work Role Activities*

Each subject is asked how they spent their time yesterday (in hours and minutes). They are also asked if that time period was a typical working day: Very typical, Somewhat typical, Not at all typical. The proportion of time on each activity is calculated by summing their total work time in minutes and dividing the reported minutes spent on each activity by that sum. Data are collected before and after implementation of a computer system: Before implementation, 6 months after implementation, 1 year after implementation.

**Activities**

Talking on the telephone
Filling out forms
Talking with patients and families
Extraneous paperwork
Helping other departments acquire information
Talking with co-workers
Data processing
Traveling around the hospital
Attendance at meetings

*Sources*: M.A. Counte, K.H. Kjerulff, J.C. Salloway, and B.C. Campbell. Implementing computerization in hospitals: A case study of the behavioral and attitudinal impacts of a medical information system, Journal of Organizational Behavior Management 6 (1984) 109–122. Printed with permission.

## *14. Network Survey*

This question is a little different. Your answers will help describe how some jobs are related to other jobs. Again, we assure you that your answers will be kept completely confidential. Please indicate: *How frequently, on the average, do you have significant discussions with other SHS personnel about how you accomplish your work?* For each person, please circle the number that best indicates the frequency of those discussions:

0 = Not once in the past year
1 = Once a month or so
2 = Several times a month

3 = Every week
4 = Several times a week
5 = Every day
6 = Several times a day

The names and units of all personnel are listed in alphabetical order in the first two columns. For example:

| *Personnel* | *Unit* | *Never* | *Month* | *Times/Mo.* | *Week* | *Times/Wk.* | *Day* | *Times/Day* |
|---|---|---|---|---|---|---|---|---|
| Jones, J. | Lab | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Smith | Admin | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| West | Clinic | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Etc. | | | | | | | | |

*Source*: R.E. Rice and C.E. Aydin. Attitudes toward new organizational technology: Network proximity as a mechanism for social information processing, Administrative Science Quarterly 36 (1991) 219–244.

## *15. Communication Between Departments*

This survey asks you to think about communication between your area and other departments in the medical center. Please circle only one answer *on each line.* All responses will be *confidential.*

How often do you usually speak to someone from each of the following departments on the telephone?

| | *Many Times a Day* | *A Few Times a Day* | *Once a Day* | *A Few Times a Week* | *Once a Week* | *Never* |
|---|---|---|---|---|---|---|
| Admitting | 6 | 5 | 4 | 3 | 2 | 1 |
| Radiology | 6 | 5 | 4 | 3 | 2 | 1 |
| Etc. | | | | | | |

(Add additional departments to list)

Note: Test-retest reliabilities for Admitting = .79, Radiology = .80, from beginning to end of 3-hour class on order entry.

*Source*: C.E. Aydin. Computerized order entry in a large medical center: Evaluating interactions between departments, in: J.G. Anderson, C.E. Aydin, and S.J. Jay, editors, *Evaluating Health Care Information Systems: Methods and Applications* (Sage Publications, Thousand Oaks, CA, 1994), pp. 260–275.

## *16. Job Design Questionnaire*

Here are some statements about your job. How much do you agree or disagree with each?

1 = Strongly disagree
2 = Disagree
5 = Slightly agree
6 = Agree

3 = Slightly disagree 7 = Strongly agree
4 = Undecided

*My job:*

| | | |
|---|---|---|
| 1. | provides much variety | 1 2 3 4 5 6 7 |
| 2. | permits me to be left on my own to do my own work | 1 2 3 4 5 6 7 |
| 3. | is arranged so that I often have the opportunity to see jobs or projects through to completion | 1 2 3 4 5 6 7 |
| 4. | provides feedback on how well am doing as I am working | 1 2 3 4 5 6 7 |
| 5. | is relatively significant in our organization | 1 2 3 4 5 6 7 |
| 6. | gives me considerable opportunity for independence and freedom in how I do my work | 1 2 3 4 5 6 7 |
| 7. | gives me the opportunity to do a number of different things | 1 2 3 4 5 6 7 |
| 8. | provides me an opportunity to find out how well am doing | 1 2 3 4 5 6 7 |
| 9. | is very significant or important in the broader scheme of things | 1 2 3 4 5 6 7 |
| 10. | provides an opportunity for independent thought and action | 1 2 3 4 5 6 7 |
| 11. | provides me with a great deal of variety at work | 1 2 3 4 5 6 7 |
| 12. | is arranged so that I have the opportunity to complete the work I start | 1 2 3 4 5 6 7 |
| 13. | provides me with the feeling that I know whether I am performing well or poorly | 1 2 3 4 5 6 7 |
| 14. | is arranged so that I have the chance to do a job from the beginning to the end (i.e., a chance to do the whole job) | 1 2 3 4 5 6 7 |
| 15. | is one where a lot of other people can be affected by how well the work gets done | 1 2 3 4 5 6 7 |

**Scoring**

*Skill variety:* Questions 1, 7, 11
*Task identity:* Questions 3, 12, 14
*Task significance:* Questions 5, 9, 15
*Autonomy:* Questions 2, 6, 10
*Feedback about results:* Questions 4, 8, 13

A total score for each job dimension is computed by adding the responses for the three items for a total score ranging from 3 (low) to 21 (high).

*Source*: T.G. Cummings and E.F. Huse. *Organization Development and Change*, 4th ed. (West, St. Paul, MN, 1989), p. 92. Reprinted by permission of T. Cummings, University of Southern California.

## *17. Job Satisfaction*

Use the following codes to indicate your response:

1 = Strongly dissatisfied
2 = Dissatisfied
3 = Neutral or No opinion
4 = Satisfied
5 = Strongly satisfied

How satisfied are you with:

| | |
|---|---|
| The nature of the work you perform? | 1 2 3 4 5 |
| The person who supervises you—your organizational superior? | 1 2 3 4 5 |
| Your relations with others in the organization with whom you work—your co-workers? | 1 2 3 4 5 |
| The pay you receive for your job? | 1 2 3 4 5 |
| The opportunities that exist in this organization for advancement—with promotion? | 1 2 3 4 5 |

**Scoring**

Sum into one global job satisfaction index.

Test-retest reliability over 14 days for individual items involving 36 secretaries ranged from .71 to .73; for overall sum, .83. Convergent validity correlations, compared to Job Descriptive Index (JDI) and Minnesota Importance Questionnaire (MSQ) for 308 public utility employees and 96 middle managers of a transport company were from .59 to .80. (See J.D. Cook, S.J. Hepworth, T.D. Wall, and P.B. Warr. *The Experience of Work* (Academic Press, New York, 1981), for details of JDI and MSQ.) Discriminant validity showed 100% of directional comparisons and Kendall's W showed .72 to.90 for patterns across different items by methods. Criterion validity showed nearly identical correlations as JDI to task structure, group cohesiveness, and supervisory consideration.

*Source*: C. Schriesheim and A. Tsui. Development and validation of a short satisfaction measure for use in survey feedback interventions. Paper presented at the Academy of Management Western Region Meeting (April 1981).