CHAPTER THREE

SOCIAL ASPECTS OF IMPLEMENTING A MEDICAL INFORMATION SYSTEM

Cure or Symptom?

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To help provide better care for patients, improve communication between departments, store information, control costs, and regulate the provision of health care, health care organizations implement medical information systems using a wide variety of technologies (Eder, 2000; Kissinger and Borchardt, 1996; Packer, 1985; Rice and Katz, 2001; Rognehaugh, 1999; Street, Gold, and Manning, 1997). In this way, we can think of medical information systems as "cures" for certain organizational problems or illnesses.

General positive impacts include improved timeliness of health care, improved format of reports to physicians and administrators, increased access to multisource databases to improve the quality of the health care process, and the introduction of management controls to contain health care costs (Lincoln and Korpman, 1980). However, as with all other organizational technologies, they may also lead to increased workloads, shifted work roles, loss of autonomy, fragmented and rationalized jobs, and conflict about evaluation of information (Braverman, 1974; Hirschheim, 1985; Johnson and Rice, 1987; Kling, 1980; Markus, 1984). Many hospital information systems indeed encounter dissatisfaction, interference, resistance, or failure due to factors such as poor system design, improper fit with organizational and social features, negative attitudes and social relationships within the hospital, medical norms about technology and patient care, and national health policies (Brenner and Logan, 1980; Dowling, 1980; Lindberg, 1979; Smith and Kaluzny, 1986). In these ways, we might also think

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of medical information systems as "symptoms" of deeper organizational problems or illnesses—that is, that why and how such systems are implemented may primarily reflect or uncover current conditions and assumptions rather than serve to solve some of those same conditions and assumptions.

This confusion between "cure" and "symptom" is partially due to the fact that social and organizational factors tend to be overlooked in information system design and implementation, but they often play the primary role in influencing the success or failure of these hospital information systems. This case reports quantitative and qualitative insights into the two-year process of implementing an integrated medical records information system in one health care organization. In the end, it is not clear whether the system was primarily a cure for the organization's information ailments or primarily a symptom of deeper organizational problems.

The System, People, and Sources

The setting is the student health service of a large urban university. The service employs between 100 and 125 full- and part-time employees, as well as numerous student workers, and treats upward of 600 student patients per day.

The system implemented in this setting was an integrated medical records information system running off a dedicated minicomputer with networked dedicated terminals and printers. The vendor and system planners designed the computerized system to approximate the paper-and-pencil systems previously used in various departments, with the most immediate and pressing problem being patient scheduling. Note this fundamental assumption: the underlying processes, work flows, and job designs were not in question and thus not redesigned; rather, the system was designed to cure current problems in information gathering, distribution, billing, and analysis. By the end of the study period, many system functions were operating:

- Scheduling appointments for patients and physicians
- Creating a common database for student demographic and eligibility information
- Generating encounter forms (which patients received when they checked in at the front desk and then took with them to each department, and which were used to note all treatment and billing information for later entry into the system)
- Entering codes for diagnoses, tests, and services performed
- Reconciling written encounter forms with data entered in the computer
- Generating reports

As students showed up for their appointments or were admitted for on-the-spot treatment, they were given an encounter form generated by the system, which they carried with them throughout their visit to the clinic and handed to the cashier before they left. This form was used to consolidate information about test requests and clinic activities and was used as the basis for entering data into the system and eventual corroboration with departmental entries for billing and analysis. The vendor's complete system could provide a wide range of integrated applications. Long-term goals and applications included functions for communicating orders for tests, reporting of lab results, analyzing patient outcomes for medical research, and identifying trends to plan for seasonal resources. However, as of the end of this study it was primarily an information collection, management, tracking, and reporting system.

The Study

The general study approach used questionnaires, moderately structured interviews, observations, and archival data collected at three time periods: several months before the new information system was implemented (T1), several months after implementation had begun (T2), and approximately one year after the second survey (T3). Researchers also observed individuals using both the previous pencil-and-paper system and the computer system in the course of their daily work. Of the 111 employees at the health service at T1 (some were seasonal or part time, so the figure of 111 overstates the number of relevant respondents), 88 were still employed at T3; 74 of these 88 employees (84 percent) completed both T1 and T3 questionnaires. The end of the T3 questionnaire asked for some open-ended comments on what the employees thought were good and bad aspects of the system and the implementation process. We also interviewed eleven people: the cashier supervisor, the appointments secretary, a lab tester, a nurse administrator, a scheduling assistant, a nurse in women's health care, the supervisor of scheduling (also a triage nurse), a nurse with wide administrative responsibilities, and two assistant administrative analysts in finance and personnel.

Problems and Issues

The following sections summarize the employees' perceptions of and experiences with organizational aspects of the new system.

Positive Aspects of the System

The survey gathered seventy-four comments on positive aspects of the system, grouped into eight categories (we provide the percentage of comments comprising each category and example comments):

- Diversity of benefits (23 percent: "improve data collection, retrieval, dissemination capabilities and potentially improve quality of care")
- Information retrieval (22 percent: "easier-to-retrieve information about patients and whatever lab work has been ordered")
- Analysis and reporting (18 percent: "using one encounter sheet from which invaluable information can be input, thus potentially producing reports such as types of patients and diagnoses")
- Not enough use of system to be able to comment (12 percent)
- Decreased paperwork (11 percent: "automatic checklist lab ordering has lowered waiting time")
- Improved scheduling (7 percent: "can see if a patient has other appointments scheduled in student health")
- New or enjoyable job (4 percent)
- Better and more services (4 percent: "the system keeps advancing clinics, patients, employees")

The personal interviews also emphasized the significance of the system for information storage and retrieval. One person said that she "is now retrieving information instead of files." Formerly, if they wanted file information, they had to fill out and sign a form requesting a student's file, have someone pick up the slip, and bring the chart back. There was always a sense that much time was spent filling in forms. They used to have to flip through separate pages per doctor and per day to find an appointment. One particular benefit will be that they can get otherwise missing information on a patient—directly from the information entered as part of the student's registration database.

Negative Aspects of the System

The employees provided nearly as many comments on negative aspects of the system:

- Slow response time and questionable system reliability (30 percent: when the system goes down, there is no verification of who has been seen)
- Increased workload and use of paper (19 percent: "cancellations of appointments do not correspond with the computer and the appointment cards—this doubles the work")

- Problems with procedures and patient flow (19 percent: "takes too long and double-booking occurs frequently")
- Problems with documentation and training (14 percent: "not everyone knows how to use it and I think everyone should know at least the basics")
- Reports and formats (7 percent: "reports are still not available easily, which was one of the main reasons for purchasing the system")
- Insufficient communication with experts and consultants (4 percent)
- Not sufficient system use to have an opinion (4 percent)
- Ergonomics, insufficient involvement/participation, and other (1 percent each)

The personal interviews also raised negative aspects of the system, such as the lack of fit of the system to the actual jobs—for example, "In one of the clinics, appointments start at 8:15 and happen every half-hour. But the system starts on the hour, at 9 A.M., and allows appointments every hour. They can't change it manually. So the appointment folk know this, and have learned to skip around the fixed times."

ttitudes Toward the System

Attitudes toward a computer system are a central focus of information system implementation research (Ives, Olson, and Baroudi, 1983; Lucas, 1981; Schultz and Slevin, 1975) and may vary widely across professions and departments, as new roles and relations may be introduced (Aydin, 1989; Counte, Kjerulff, Salloway, and Campbell, 1987; Fischer, Stratmann, Lundsgaarde, and Steele, 1987).

The employees did have generally positive attitudes toward the computer system ("the system will be, or is, worth the time and effort required to use it," a 7-point scale) at both T1 and T3. The mean attitude for all employees, however, decreased significantly from 6.02 (agree) at T1 to 5.27 (between slightly agree and agree) at T3 ($p < .01$). Medical personnel reported a lower assessment and a statistically significant decrease from T1 to T3 (5.86 to 4.84—closer to slightly agree than to neutral, $p < .01$). The initial decision to emphasize administrative (scheduling, billing, medical records) over medical applications (diagnosis, trend analysis) resulted in the negative physician attitudes at T3, although administrators were attempting to convince physicians that the system would eventually benefit them as well. Members of the nonmedical occupations also reported a slight, but not statistically significant, decline from 6.19 to 5.77, but were more positive at both time periods.

A summary regression analysis showed that positive attitudes at T3 were moderately explained by support from one's work unit for learning how to use the system, organizational policies that support learning about and experimenting with

the system, and lower levels of system use. Reasons for the diversity of attitudes seem due to age (less willing to change), prior computer experience, more professional experience, fear of making a mistake, and some technophobia. A final general theme was the importance of both presenting, and having, reasonable expectations: "People look for it to be perfect, but it's not."

Implementation and Training

The implementation process was characterized by ongoing informal communication, sandwiched into a busy work schedule that tried to encourage the use and development of new system-based procedures. Individuals often selected their own contacts to discuss the computer system, and individuals in medical records and in finance and personnel assumed the role of computer liaison or "guru" for workers in a number of departments.

Survey respondents provided nearly fifty comments about the implementation process, grouped into six categories:

- Need more frequent updating, training, professional instruction, and a user manual (20 percent)
- Insufficient implementation experience or system use to have an opinion (20 percent)
- Involvement and communication (17 percent: "More people who are working with the system, and people affected by it, i.e., the clinicians, should have been involved in choosing a system")
- Debugging and timing of implementation stages (17 percent: "I would have agreed to pay for the system after it was tested and had proved to be doing what it should have done from the beginning")
- Vendors or equipment (15 percent: "Would have looked at more providers, systems and options")
- Documentation and procedures (11 percent: "The program for the generation of requisition slips is poorly designed. It has too many steps and commands and I feel it could be greatly improved upon!")

Overall, the interviewees had mixed feelings about the ease of learning the system and felt that experimentation with the system was important to learning but was not supported by the organization—for example, "The problem comes from those who really want to know how the system works and the meaning of alternatives on the menu. Some terms are too complicated or misleading." Another staff member said that she learned by making mistakes and solving them, as she

"fiddles around with it during extra time. Now that the system's up, however, there's not so much time to do this."

artmental Interactions

Integrated hospital information systems that create common databases require health care departments to cooperate, increasing interactions among departments, such as between nurses administering drugs and a pharmacy's billing practices and subsequent revenues (Aydin, 1989; Aydin and Rice, 1991, 1992). These interdependencies necessitate standardized forms, terminology, and policies and procedures agreed on by the departments involved. In turn, common access to standard resources may reduce dependence on other departments for access to information, possibly reducing conflict. Computers can trigger social dynamics that may either modify or maintain the structure of the organization (Barley, 1986; Stryker, 1981).

Overall, employees perceived a very slight increase in information exchange with all other health service departments ($M = 4.53$ where 4.00 is "no change" and the range is 1 to 7). Nonmedical personnel perceived greater increases than did medical personnel. Members of the medical records department perceived greater increases in information exchange with all other departments than did employees in any of the other departments ($p < .01$), while medical records, the lab, primary care, and finance and personnel were the departments mentioned by members of other departments as being most involved in increases in information exchange. Communication-based forms of involvement in implementation (communicating with systems personnel and trainers, communicating about new ways to use the system, and receiving support from supervisors for doing so) were the most important factors in predicting increases in interdepartmental information exchange.

Design

There was little or no job redesign accompanying the system implementation. One interviewee felt that "the results are very unfair; the job descriptions do not reflect the changed responsibilities in people's jobs." These were discussed in the light of the new system, but no changes followed. In fact staff "absorbed the implementation" in their "spare time." As a result, many personnel had no spare time or energy left. Thus, paradoxically, the system created a need for more help and staff. But the administrative analysts insisted that in the long run, the essential benefit would be better service to the students.

Thus, without any intentional policy or strategy, some system characteristics forced changes in job designs and organizational interactions.

Complex Consequences

One of several paradoxes associated with the system was the summer analysis project started up by the service's director. During the summer, students had to pay for their services unless they obtained special insurance, but even then, the routines were different than they were during the regular year. Before the system, there was no insight as to the effect of all these students and different pricing policies. This was important because most of the health care service's supplemental income came during the summer, and the same problems arose every summer, but the service had no information on the reality of the situation. The director had one of the assistant administration analysts manually log all cash receipt forms to identify the scale of this problem. She saw it as a one-time special project, which ended up lasting the entire following year because it took so much clerical time to enter all the data, which she analyzed using a spreadsheet program. With the new system and its ability to capture service, demographic, and billing information, staff could now do the same kinds of analysis they did for the summer analysis all year long. The consequence was that what was seen before as a special project, one of several that researched unique problems, now took up nearly all the student work hours, as well as some of the analyst's time, so the finance office had no additional resources to do the special projects, including learning more about the system and analyzing what kinds of reports could be done.

Implications

Not surprisingly, this medical information system was designed to overcome limitations of paper-based work and had a wide variety of positive and negative outcomes. Perhaps more surprising, a new, complex medical information system may really be more of a symptom than a cure. It can provide an occasion to reveal or engage many underlying processes and problems in the organization, ranging from technical policies, and implementation and job design decisions, to social norms across departments and professions. The assistant administration analyst noted that the system "brings to light all these operational problems," such as a disorganized or tangled procedure. It makes obvious the need for policies and procedures. Why does the system do this if the policies and procedures and staff were not needed before the system? The respondents thought about this question and

basically decided that before the system, things were a mess but had not been perceived as such. Rather, they felt that the main problem or organizational illness was the dependence on paper-based work processes. They thought that the growing awareness of the need for policies and procedures, and the need to run an efficient and effective organization, was a change associated with the new administrators. As the service grew, it began to need organization. This need for improved organization was part of the rationale for the system (for example, to obtain demographic data, have more accurate information). Once the system was in place, it "forces you to articulate things"—not only to have accurate data input but to understand how jobs and processes are related. Before, there were always several ways to do a procedure because each person or supervisor could solve it differently. With the new system, it was necessary to know and use the proper way to do the procedure.

The primary implication from this and other studies is that the social aspects of system implementations are by far the most critical aspects—both as influences on and outcomes from organizational change associated with the system. In this sense, while medical information systems may be seen by some as a "cure" for organizational problems, they may also be "symptoms" of underlying organizational assumptions, managerial policies, and social roles.

Discussion Questions

1. What are some of the central communication problems and issues associated with the implementation of this information system?
2. What are two implementation procedures or policies you would have changed if you had been in charge? Why? How would things have been different with these changes?
3. What are some components and functions of a health care institution that are necessary to provide good patient care but are not visible or obvious to the patient?
4. Identify and debate trade-offs between two technical system characteristics or features and two social system characteristics or features.
5. List and describe two examples each of what you would consider to be successful and unsuccessful aspects of the information system in this case.
6. From the results provided in one of the seven organizational aspects, identify and analyze how problems or issues associated with the implementation of the medical information system were actually symptoms of underlying organizational problems or illnesses.
7. Based on one of the associated journal articles (Aydin and Rice, 1991; 1992; Rice and Anderson, 1993; Rice and Aydin, 1991), discuss one of the examples or results from this case in more detail.

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