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Information Systems Inefficiencies and Changing Work Routines

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Abstract

This thesis focuses on the effect of nursing staff's redundant work routines on error and quality of care in one Critical Access Hospital in rural Wisconsin, USA. Methods were based on participatory design and an ethnographic approach, and included individual interviews and observation-based interviews. Introduction of a computerized information system was scheduled for the case study site and this thesis makes pre-implementation suggestions regarding staff training, interface features desired by the future users, and removal or restructuring of certain redundancies. The contribution of this thesis to information systems research is a classification system for determining the degree of redundancy (productive, gray-zone, and unproductive) present in the task chains of specific work routines, and a second classification system for determining to what extent modifying or removing an unproductive redundancy returns value. The degree to which an unproductive redundancy may be modified or removed is weighted against the difficulty of changing the work routines associated with that redundancy as well as the expected impact on other routines.

Preface

Before earning a B.S. from NTNU and starting on an M.S. and this project, I earned a B.A. in psychology and history, as well as a teaching degree from Columbia University in New York City, USA. My motivation to study information systems has therefore sprung from interdisciplinary interests connected to the way people communicate, as well as processes related to development and learning. Studying information flow and how to best educate employees when their routine work changes appealed to my personal interests and provided an opportunity to apply interdisciplinary knowledge to an information systems study.

I've seen as well as personally experienced both effective and ineffective work routines in several hospitals including especially the processes related to information transfer. In particular, the summer prior to starting my thesis project, I worked in the main office at a Norwegian psychiatric clinic. Because of my central placement and direct involvement with patient journals, I witnessed both verbal and written examples of information transfer, some of which was productive, and some of which was garbled or otherwise unproductive. These various experiences sharpened a desire to apply my interdisciplinary background to information systems and particularly health informatics.

Though my primary interest is health informatics, problems related to complex work routines and communication channels are evident in most work places. This project is therefore applicable to non-healthcare environments and many of the problems discussed can be generalized to everyday issues in other professions. Because of the importance of understanding written and verbal "shorthand," and as a native English speaker interested in studying communication behaviors in a hospital, there were many compelling reasons for me to conduct my case study research in an English environment. By doing so, I minimized the chance of miscommunication due to language differences. Of course, people use language differently and a common native language is no assurance against miscommunication. In fact, I found that the often hectic setting at my case study hospital, and the use of profession-specific terminology by the nursing staff, made it difficult to always be sure that, what I thought I'd understood, was actually what was intended.

In these cases, it was necessary to ask for confirmation or clarification.

I had the freedom to formulate the specifics of my project according to what I considered the most productive path to the goal of reorganization and increased productivity. My case study allowed me to not only map out those hospital's work routines on which I chose to focus, but also provided a dynamic behavioral and educational study. For me, the independence and ability to control the direction of my project and to develop and answer questions was very satisfying.

Finally, I would like to thank my academic advisor, Professor Eric Monteiro; with his guidance I learned a great deal about generalizing knowledge and had a thorough sounding board for discussions about organization of my thesis as well as organization of my field work. I have grown in my ability to think out-of-the-box and have received good feedback about how to apply my strengths and work on my weaknesses in future ventures. Considering that I had long US stays during this past year, I would also like to thank my family for their enthusiasm, support, and flexibility.

Contents

Chapter 1

Introduction

It was in the early 1990s that research on medical error prevention first began to be a focused effort. Then in 1999, a scathing Institute of Medicine (IOM) report led to a US Presidential Order which called for improvement in healthcare quality and patient safety. The Presidential Order called for recommendations from the Quality Interagency Coordination Task Force, established in 1998 by President Clinton (Agency for Healthcare Research and Quality, 2000b). Standardization and computerization of information systems (IS) are often considered means by which to limit error and inefficiency in healthcare, as well as tools for restructuring existing information systems. Indeed, starting in the 1980s, the healthcare industry began to become increasingly computerized, though two decades later, there is still no industry IT standardization. Stead, Kelly, and Kolodner (2005, p. 116) explain that "software applications often become a bottleneck in a health care organization trying to rapidly improve its processes." And referring to findings by the independent research group The Standish Group International, Inc. (1999), they explain that most software projects across all industries exceed their budget and estimated delivery date. According to The Standish Group International, Inc. (1999, p. 2) classification of projects as successful, failed, or challenged in 1998, only 26% of projects succeeded within the preset terms of the project while 28% failed and 46% were challenged, meaning that features may have been removed and costs and time until delivery were inflated. Information system project failures

and challenges occur across a range of industries where healthcare is but one example of the many fields in which reorganized, computerized information systems may improve quality and reduce error. Within the scope of healthcare, the case studied in this thesis is a specific instance from a specific location and time, and the general problems and solutions resemble those encountered in specific studies undertaken in other industries. Many companies across almost all industries face the need to reorganize if they want to remain competitive and productive. However, the process of reorganization is full of potential pitfalls which may typically involve an unreliable and long timeline, changing entrenched work routines and dealing with employee resistance. Goals of reorganization tend to vary around improving quality and minimizing inefficiency while maximizing efficiency.

In addition to an often unreliable timeline, when the decision is made to restructure an existing information system—whether that information system is paper-based or computerized—or to adopt a new information system within a given industry and in this case, a given healthcare facility, new debates and challenges emerge. These range from how to best re-educate employees on how to restructure work routines such that adoption of the new system represents an improvement rather than merely a change. Before steps may be taken to reduce inefficiencies and error within any field, it is necessary to identify human and IS shortcomings and how these interrelate. An often contributing and important factor is that the underlying paper information system is rife with problems which ought to be addressed prior to implementation, but which are instead expected to be fixed by a new system. The obvious error in this approach is nicely summarized by Bemmel and Musen (1997, p. 331) who write, "Computers are a means to an end and not an end in themselves."

A second and closely related error is to assume that imposing higher level structuring via an IT system will necessarily improve the relevancy (Ash, Berg, and Coiera, 2004, p. 106) and quality of that which is shared. Finally, from recognized academic literature and case study descriptions, the importance and influence of social factors upon the technical—and vice versa—becomes evident; from literacy, competence, and professionalism to institutional resources and support mechanisms, social factors significantly affect and stand to alter the course of

events involved in IS implementation.

What this paper hopes to contribute to IS studies is—in the context of a case study—identification of inefficiencies and patterns of redundancy and opportunity for error within healthcare due to the human component, the information system, and the interplay between the two. In particular, this research focuses on the human component, not only that which is successful in reorganization and implementation of new systems but what doesn't work as well or at all. Integral questions include:

- What are the inefficiencies of the current work routines?
- Where does the risk of human-related errors seem likeliest in the current work routines and how might this risk be reduced?
- How does the human factor affect the process of reorganization, and what is necessary to encourage and aid employees during the shift?

These questions will each be addressed three times, once in each of the following three main parts of the thesis:

- Part I is a literature-based discussion of the coordination of the human component and working routines in information systems and of medical standardization and the potential for error;
- Part II introduces relevant case study examples and details concerning the human component, the existing information system at the case study hospital, and work routines; and finally,
- Part III uses literature and case study examples to address work routines and the potential for error due to interplay between the human component and information systems.

Part I

Theory and Literature Review

Chapter 2

Western Healthcare

Canada and most European countries have national, socialized healthcare systems as well as varying levels of available, privatized medical services. In contrast, the US is mostly privatized with a more limited socialized sector serving mainly low-income and elderly persons. Despite international differences, standardization and IT development in healthcare are shared international challenges. European use of electronic patient records in general practitioner offices is one of the best in the world (Bergstrøm and Heimly, 2004, p. 345). Standardized messages for communication between hospitals and general practitioners was pioneered in the United Kingdom and the Netherlands in the 1980s and has since spread throughout much of Europe with particular success in Scandinavia (Voss, Heimly, and Sjögren, 2005). For example, the Swedish national health care network (Sjunet) was started in 1998; it makes possible the consultation of specialists from around the country. A cost-benefit study indicated that Sjunet has resulted in great savings for both the national healthcare system and the patients (Voss et al., 2005). Sweden, Denmark, and Norway have a history of cross-national healthcare collaboration. They are currently involved in a project with one hospital in Estonia and another in Lithuania which is intended to further facilitate international communication by learning more about what obstacles exist and how to overcome them (Voss et al., 2005). Despite differing economic principles governing healthcare between European and North American countries, providing equal access to

healthcare, as well as a need to improve quality while simultaneously cutting costs and improving efficiency, has resulted in similar trends and research interests with particular focus on standardization and health informatics. Given the context in which this thesis is written—a study of a US healthcare institution conducted by a student in Norway—it is useful to provide a brief orientation to the similarities and dissimilarities between Norway and the US.

2.1 Demographics

Demographic considerations are a significant factor in healthcare and are therefore a worthwhile comparison point between Norway and the US. As of July 2006, the estimated Norwegian population will be 4,610,820 million and the estimated US population will be 298,444,215 million (CIA, 2006). Excepting the Western United States, a higher percentage of the US population lives in metropolitan rather than non-metropolitan areas (US Census Bureau, 2003, chap. 2). The US Census Bureau (Sevetson, 2002, p. 7) defines urban as "all territory, population, and housing units located within urbanized areas and urban clusters;" both urbanized areas and urban clusters consist of a "geographic core of block groups or blocks [that] must have a population density of at least 1,000 people per square mile, and adjacent block groups and blocks with at least 500 people per square mile" where urbanized areas have a population of at least 50,000 people and urban areas have at least 2,500 people and fewer than 50,000. Even though the metropolitan population predominates over the rural population in the US, both Norway and the US have a sprawling rural population for whom equal access is necessary.

According to The National Advisory Committee on Rural Health and Human Services (2006, p. 11), the number of pharmacists in the US is disproportionately low for rural compared to urban areas. Skilled nursing care for the elderly is insufficient in rural areas and provides another example of disproportionate availability of services in urban versus rural areas (The National Advisory Committee on Rural Health and Human Services, 2006, p. 13). These examples exemplify one sig-

nificant threat to rural healthcare. The relatively small size of the populations and the often lower pecentage of famililies with health insurance mean that healthcare access in rural areas is not equal to healthcare access in urban areas (The National Advisory Committee on Rural Health and Human Services, 2006, p. 11). Considering that perceived access to healthcare is reported to affect health in a community (Kozak, Hall, and Owings, 2001, p. 225), the closing of pharmacies and other healthcare providers in rural areas poses a threat to healthcare access and therefore to community health. Rural healthcare advocacy groups are intended to protect the survival and quality standards of the non-urban hospital; state and local health care representatives identify "access to quality health services" as a top rural healthcare priority (The National Advisory Committee on Rural Health and Human Services, 2006, p. 13). The Rural Wisconsin Health Cooperative (RWHC) is one example of a rural healthcare advocacy group. The RWHC is owned and run by twenty-nine rural, acute care hospitals, has received federal grants to realize model initiatives, and according to their website, is nationally recognized as one of the best models for networking rural hospitals (Rural Wisconsin Health Cooperative, 2004). Implicit in its name, the RWHC has a particular focus on local care and in particular the positive effect of local healthcare on the local economy. Moreover, the RWHC focuses on Medicare and health insurance equity, and quality management (Rural Wisconsin Health Cooperative, 2004). The Small Rural Hospital Improvement (SHIP) grant program awards funds to eligible small, rural hospital applicants; SHIP grant funds are intended to be used toward payment systems' costs, health insurance equity, and to help "reduce medical errors and support quality improvement" (Rural Health Resource Center, 2005, p. 4). In Wisconsin in 2002, the State Office of Rural Health partnered with the RWHC to meet the goal of encouraging small rural hospitals to use their SHIP funds toward improving IT infrastructure via use of the RWHC Wide Area Network (Rural Health Resource Center, 2005, p. 15). Telemedicine is an appealing solution to the challenge of providing equal access to health services in rural areas in Europe and North America (Bergstrøm and Heimly, 2004, p. 341). In particular, emergency patients in rural areas may benefit from telemedicine as it can reduce unnecessary and potentially dangerous transportation of injured patients (Bergstrøm and Heimly, 2004, p. 343). The National Advisory Committee on Rural Health and

Human Services (2006, p. 12) asserts that via use of health information technology, rural communities might be able improve healthcare quality and public health via "disease surveillance and targeted health education."

2.2 Healthcare Quality

In 2005, the University of Wisconsin Population Health Institute found that the most important determinants of health status are: "health behaviors (40% of determinants); socioeconomic factors (40% of determinants); physical environment (10% of determinants); and access to healthcare (10% of determinants)" (Zank, Kaufman, Peppard, Remington, and Kindig, 2005, p. 3). The determinants are not mutually exclusive and reducing one will likely affect others as well. For example, lower socioeconomic groups tend to have higher rates of smoking, higher fat and added sugar diets, higher alcohol use, and less physical activity (Kim, Symons, and Popkin, 2004, pp. 184, 190). Though the health determinants are not mutually exclusive, it is true that financial status is not a factor in Norway while it may be one in the United States. EMTALA is a US federally mandated law that states that any hospital which receives federal payments must provide treatment before requesting payment information from any person entering the emergency room. Someone can visit the emergency room for any health problem even if that problem would be more appropriately handled by a general practitioner. Some treatments, and particularly those required by law, may be attained at free clinics; for instance, US children and teachers may not start school without proof of vaccination which they may receive at free clinics. Despite the fact that uninsured persons can still receive needed medical treatment, health insurance often does promote improved health status because of well-care and prevention activities. US healthcare coverage is funded via any constellation of private pay, private health insurance, and/or government health insurance. A breakdown of insurance coverage is graphically illustrated in Figure 2.1.

Reasons for being uninsured may be due to low socioeconomic status (30% of those considered poor had no health insurance (US Census Bureau, 2003, chap. 15)),

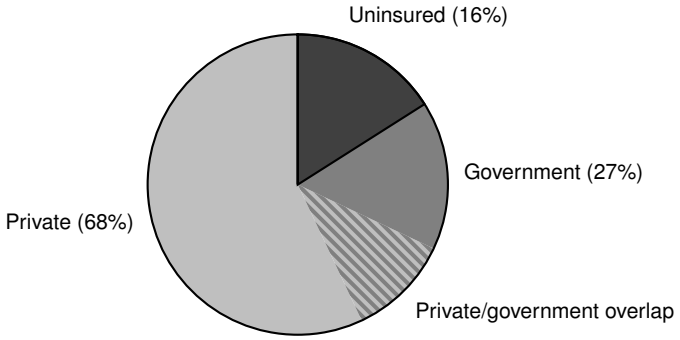


Figure 2.1: Breakdown of Insurance Coverage (DeNavas-Walt et al., 2005, p. 19)

being an illegal alien, or being caught in a gap such that they earn too much to be eligible for Medicaid, but choose not to or are unable to afford private insurance. Given the country-wide importance of a healthy population, it is wise to reduce the percentage of uninsured. The Health Insurance Portability and Accountability Act of 1996 (1996), known as HIPAA, is one influential response with the stated purpose "to improve portability and continuity of health insurance coverage in the group and individual markets, to combat waste, fraud, and abuse in health insurance and health care delivery, to promote the use of medical savings accounts, to improve access to long-term care services and coverage, to simplify the administration of health insurance, and for other purposes." According to the CMS, HIPAA may lower one's risk of losing existing insurance coverage, simplify switching of health plans and/or help an employee purchase new insurance if the employee loses employer coverage and has none other available. Additionally, HIPAA has significant ramifications for IS and IT in implementing new systems as well as in facilities where these systems already exist. This is due to the fact that HIPAA mandates improved security and therefore the need to reevaluate established practices such as walking away from a computer where one is logged on and in the process of viewing patient data. To clarify, HIPAA is a change agent working on behalf of standardization and quality improvement within the medical profession.

As with HIPAA, one aim of healthcare policies and research is to improve healthcare quality. The US government agencies responsible for healthcare policy and research fall under the US Department of Health and Human Services, and in-

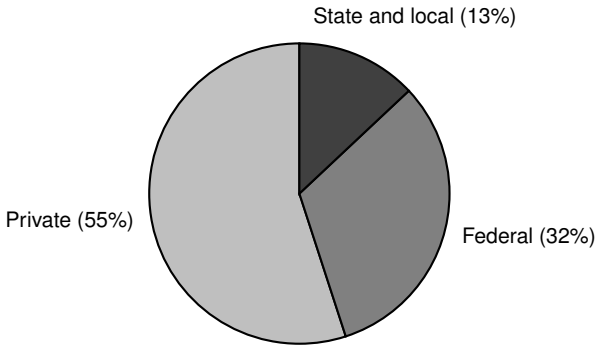


Figure 2.2: Breakdown of Health Care Funding (Centers for Medicare & Medicaid Services, 2005b)

clude the Agency for Healthcare Research and Quality (AHRQ) and the Centers for Medicare and Medicaid Services (CMS). To healthcare providers, the percentage of total cost paid by various sources is of less importance than the total percentage of people receiving needed preventive to emergency care. For this reason, care and quality assurance have fallen under government regulations aimed at reducing the number of uninsured. Figure 2.2 gives an overview of financial allocations from the public and private sectors for healthcare.

In 2004, Norwegian healthcare spending represented about 35% of the country's annual budget (Bergstrøm and Heimly, 2004, p. 337). Norway has a low population density, falling birth rates, and increasing life expectancy; given that the average age is increasing, Norwegian healthcare will face the increasingly common international problem of having to improve services for a more demanding, aging population while simultaneously cutting costs due to a reduction in the number of eligible workers (Bergstrøm and Heimly, 2004, p. 346). In Norway today, the ratio of working age people (20–67 years) to elderly (older than 67 years) is 5:1 and in 2050 it is predicted that this ratio will be 2.5:1 (Hygen, 2005). If current national healthcare is to be maintained or improved, it is imperative that the annual healthcare budget not be raised beyond that which is maintainable by the future working age population. Improving efficiency is often one way of cutting costs and may be one of the strongest arguments for IT development in healthcare (Bergstrøm and Heimly, 2004, p. 347). If national healthcare is not improved, healthcare quality

may either be degraded or socialized healthcare will not be sustainable.

Similar threats to quality care and needed improvements in efficiency exist in both Norway and the United States. Due to the national healthcare system in Norway, socioeconomic factors logically play a smaller role than in the United States, but access to healthcare is a potential area in which the level of Norwegian health may be reduced. In fact, Norway's relatively small population and barriers in the natural terrain mean that the greatest current medical challenge in Norway is low population density (Bergstrøm and Heimly, 2004, p. 337). Eighty-five hospitals serve the approximately 4.6 million population and, therefore, many must travel long distances for certain types of medical care (Bergstrøm and Heimly, 2004, p. 337). In the United States, one means of improving rural healthcare access while maintaining requirements for efficiency and fiscal responsibility is the ability of hospitals to seek Critical Access Hospital (CAH) status. According to the Centers for Medicare & Medicaid Services (2005a, p. 2), Medicare pays CAHs 101% of the "allowable and reasonable costs" incurred for most services rendered to Medicare beneficiaries. Rigorous criteria limit the pool of eligible hospitals. Specifically, under the Congressional Balanced Budget Act of 1997, in order for a hospital to receive the CAH designation it must be more than thirty-five miles from any other hospital or, in the case of mountainous terrain or only secondary roads, it must be fifteen miles from another hospital, or it must be certified by the state to be a "necessary provider" (Centers for Medicare & Medicaid Services, 2005a, p. 1). Additionally, a CAH must be in a rural area in a state that has the "State Flex Program," must have twenty-five or fewer beds, must have an average length of stay equal to or less than ninety-six hours, and must provide 24-hour emergency services (Centers for Medicare & Medicaid Services, 2005a, p. 1). Meeting these criteria does not mean that a hospital is automatically deemed a CAH; given the benefits involved, any applicable hospital must apply to receive CAH status. The focus of a CAH should be community need.

2.3 Health Informatics

While there are regions in the United States that interconnect and take advantage of telemedicine, the health networks in the US tend to be relatively small and there is no current national health IT network standard. In contrast, Norwegian healthcare is far more standardized and interconnected and represents an ongoing and bottom-up effort developed over a fifteen year period (Hygen, 2005).

Norwegian healthcare is divided into five regional health nets (Hygen, 2005). This technical infrastructure indicates a high level of and devotion to health informatics in Norway. Continuing to promote health informatics in Norway is considered one means of increasing efficiency. This dedication to promoting health informatics is evident through the formation of various national research centers such as The Norwegian Center for Health Informatics (KITH), The Norwegian Center for Telemedicine (NST), and The Norwegian Center for Electronic Patient Journals (NSEP) (Bergstrøm and Heimly, 2004, p. 338). In addition, the E-Norway plan is a government plan outlining goals for private and public sector IT development (Bergstrøm and Heimly, 2004, p. 337). In 2001 an electronic patient journal standard was released in Norway (Bergstrøm and Heimly, 2004, p. 344). Nearly 100% of general practitioners have electronic patient journals and 80% of hospitals have them, though the estimates for system use vary substantially and some systems seem to parallel rather than replace paper-based work routines (Bergstrøm and Heimly, 2004, p. 345). Even so, the mere availability is far higher than the US estimates. One advantage of such coordination in care is an ability for patients to become more involved in their treatment, which is believed to be a precursor to improved quality of care (Hygen, 2005). Regarding efficiency and quality of care, Voss et al. (2005) write that, "The objective with the Norwegian National Health Network is to contribute to high quality and coherent health and social services, by being a sector network for effective cooperation between the different service sections in the sector."

Despite the lack of a national healthcare network in the US, there are multiple small networks scattered across the country and these have developed different standards. As in Norway, there is a similar belief that efficiency will be increased

via greater use of health informatics and there are also US organizations for whom a goal is the promotion of health informatics: recall the aim of the RWHC to create a network among some subset of its twenty-nine member hospitals. Other examples of indirect healthcare networking are agreements between competing institutions that are forged solely because of federal mandates and/or concern for improving care quality across a region. For example, one aspect of the CAH agreement for CAHs in the region around LaCrosse, Wisconsin is a provision for use of MedLink AIR to transport patients who cannot be treated at the more limited Critical Access Hospitals to the better equipped Gundersen Lutheran facility in La Crosse, Wisconsin; Gundersen Lutheran Medical Center is a large, private healthcare provider which offers care in 19 counties throughout western Wisconsin, northeastern Iowa, and southeastern Minnesota (Gundersen Lutheran, 2006a). Since 1992, Gundersen has operated the emergency medical helicopter known as the MedLink AIR (Gundersen Lutheran, 2006b). Of course, use of the helicopter is based on medical need, not ability to pay and therefore it is only patients that require air transport that will be transported by MedLink AIR (Gundersen Lutheran, 2006b). One interviewee at a CAH gave the example of what happens when a heart attack victim comes into the ER; hospital medical staff have a certain amount of time to evaluate the patient before MedLink AIR is called and within thirty minutes the patient is in the air. This is, of course, the idealized situation: if the helicopter is on another call or the weather is inclement, the patient may have to wait; or if it is essential to get that patient to a larger facility, the patient may have to be driven. Seventy percent of the patients transported by MedLink AIR are from all facilities that lack the resources necessary to care for the given patient; the remaining thirty percent of patients transported to the La Crosse Gundersen facility are transported directly from an accident site (Gundersen Lutheran, 2006b).

IT development in healthcare allows for an increase in telemedicine, medical transportation and accessibility options—particularly for rural residents—and this suggests that, on the umbrella organization level, a cohesive IT network facilitates improvement of at least some services. Of course some services may be harmed by a more standardized, structured IT system, and it is uncertain whether IT development translates to improved quality and reduced inefficiency for individual

healthcare providers. It is therefore useful to identify what inefficiencies exist and what quality improvement entails.

Chapter 3

Evaluating Information System Inefficiencies

Information systems (IS) are those systems—paper and electronic—that help maintain order and communication within a work place. Whether informal or formal, all work places rely on the stability of an established system. Unfortunately, these systems are far too often overly complicated, with unproductive redudant processing and poorly designed routines. Inefficient systems may be improved via a reengineering process wherein work processes are evaluated, possibly redesigned, and then formalized into standard sequences. This process of evalution ought to examine even the most intricate details of work coordation within the organization and will henceforth be called "articulation work" (Gasser, 1986, p. 211). Following re-design, many posit that the formalization of routines in a previously paper-based system may be aided by introduction of a computer-based IS. Some IS researchers have, however, been less optimistic and identify compelling challenges. An understanding of the process of observation and re-design may be aided by research from the fields of participatory design, ethnographic study, and Computer Supported Cooperative Work (CSCW).

3.1 The Human Component

Referring to CSCW, Gasser (1986, p. 208) discusses the distinction between "primary work" and computing work, which "presumes the existence" of the so-called primary work. This primary work is separated into tasks, each of which are the responsibility of an individual or group within the organization (Gasser, 1986, p. 209). When these tasks are merged, a productive whole emerges. Hence, for the productivity of the organization, the individual human tasks must be properly carried out and must not be in conflict with one another. Coordination relies on the commitment of individuals in fulfilling their subtasks (Gasser, 1986, p. 210). Gasser (1986, p. 210) refers to this collection of subtasks as the "task chain". When evaluating work production, it is therefore logical to identify the underlying task chain, and having done so, to identify unnecessary or redudant links. This is an early practical step in the process of computerizing an information system. This, however, overlooks the human social and emotional attributes that affect commitment to and cooperative completion of the task chain. Furthermore, any task chain will likely intersect with other task chains, which together compose the organizational web, what (Gasser, 1986, p. 210) refers to as the "production lattice", and that which helps maintain productive stability.

The network of employees and their organizational systems creates the "organizational form" of the organization itself (Bowers, 1994, p. 288). Bowers (1994, p. 288) further clarifies that the organizational form refers to the sum of organizational systems within a company, and explains that organizational form will affect whether or not a new technology is accepted or rejected. The coordination of the human and computer subtasks within this organizational form or production lattice may be described by actor-network theory. This theory defines the relationship of technology and socially hierarched human and nonhuman daily-life objects (i.e., the network of actors) (Akrich, 1992, p. 206). In this network, actors and technologies reciprocally define one another (Akrich, 1992, p. 222). Both the object and the actor network must be constantly flexible (Akrich, 1992, p. 206). In this "reciprocal [script] adjustment", technical objects establish roles and shape actant relationships and actants may also re-shape technical objects (Akrich, 1992,

p. 206).

The British socio-technical approach neatly addresses the issue of actor-network theory and the way that various organizational roles interact to form a unified whole. Sociologists and technologists define two extremes for describing the relationship, or script, between a technology and its surrounding society (network of users). These two extremes are social constructivism and technological determinism. These two extremes mutually exclude the simultaneous success of both technology and social need. Akrich (1992, p. 208) presents the conflict as a need to merge the physical script of the technical object with the socio-technical script, which refers to the persons or contexts in which the technical object is to serve in society. She explains, "Thus many of the choices made by designers can be seen as decisions about what should be delegated to a machine and what should be left to the initiative of human actors. In this way the designer expresses the scenario of the device in question—the script out of which the future history of the object will develop" (Akrich, 1992, p. 216). A self-evident part of the argument for a balanced script, or a socio-technical script, is that it is human beings who conceive technological ideas; new technological ideas are framed by human context and human design. Even if a technological design is conceived only physically and without active consideration for likely social reaction, the technology still exists in a human context. Therefore, it logically follows that social constructivism must play some role in the interaction of technology and its human actor network. Similarly, there are abundant examples of how technological determinism influences the relationship between technology and the actor network; for example, consider the wife in a family where the husband spends so much time in front of the family computer that the wife psychologically pushes away any desire to interact with the computer (Aune, 1992, p. 97). Yet, over time, this same wife may be nonetheless drawn to the computer because of the benefits of using a word processor. How the computer shapes the home and is pro-actively shaped by the home user can be viewed in terms of what may be called domestication.

Similar to the socio-technical approach in its emphasis on the human component, Scandinavian participatory design aims at achieving an "industrial democracy" (Ehn, 1993, p. 48) via an emphasis on the entire system—technical and human

components. Participatory design draws on tools from and is heavily influenced by many of the same principles as the socio-technical school of thought, but Ehn (1993, pp. 48,50) and others posit that participatory design is better suited to the "democratization" of systems. Ehn (1993, p. 74) emphasizes the use of "playful activity" in participatory design as a means to make users engage in design activity. Further, encouragement of developer and user participation helps highlight needed IS attributes, as well as potential product shortcomings. A keen, observant developer may amass information about user weaknesses, which may then be re-designed in the final product to be more user-friendly (actor-friendly) and situational context-aware (network aware). By including users in the design process, this seamless incorporation of user needs situated within a contextual awareness will be made possible prior to implementation rather than recognized and addressed as an afterthought. Ehn (1993, p. 61) writes of Christiane Floyd's opinion of the product-oriented view of designing computer systems that such an approach "leaves the relationship between programs and the living human world entirely unexplored, providing no way to check the relevance of the specification or to accommodate learning and communication."

Given that the human factor is deemed to be integral to the success of participatory design, utilizing ethnographic study to better understand individual actors, their tasks, and the context in which they are situated may aid in the paritipatory design of an IS aimed at supported cooperative work. Researchers using ethnographic study are interested in workers' actual routines—Gasser's (1986, p. 210) task chains—rather than merely their descriptions of them (Schultze, 2000, p. 4). Suchman (1995, p. 61) writes, "Problems arise, however, when normative representations are either generated at a distance from the sites at which the work they represent goes on or is taken away from those sites and used in place of working knowledges." This said, provided data is properly collected, Schultze (2000, p. 16) describes a process of reflection wherein the researcher records notes and revisits them following on-site work with the aid of "hindsight, a more holistic understanding, and a specific theory." The confessional writing style is therefore a good tool to employ in an ethnographic study. It is an uncommon approach and requires suspension of one's own preconceived ideas in favor of allowing the sit-

uation to provide insights (Schultze, 2000, p. 7). Additionally, it is important that the ethnographer provide revealing personal accounts, such as age, gender, and personal opinions about introduction of a new system, and views of social and work related aspects of the current information system, as well as relevant background information (Schultze, 2000, p. 31). These attributes establish the "filter" through which the researcher experiences and perceives the world, and which supports the researcher's "cultural critique" of that which is studied (Schultze, 2000, pp. 35–36). While worker routines are integral to an ethnographic study, a culture of blame should not be advocated (Nordenberg, 2000). Rather, routines must be viewed as part of the overall system—the integrated human and technical components—and "preventing future errors is best achieved by designing a safer overall system" (Nordenberg, 2000).

3.2 Coordinating Routines

Can multiple workers' routines be organized without an understanding for why the routines follow the schedules they do? Is it possible to integrate multiple work processes without first understanding how the processes interrelate and how they function under the current form of organization? Is Computer Supported Cooperative Work (CSCW) always an improvement over the paper-based system?

These questions point to a problematic IS theme: common practice indicates that it is believed that "service fragmentation," or poorly coordinated work, may be alleviated via introduction of a "common information infrastructure" (Hartswood, Procter, Rouncefield, and Slack, 2003, p. 241). The problem with this approach is that the integration necessary to establish a common information infrastructure requires identification and understanding of the processes—both formal and informal—that occur in the workplace. The perhaps most challenging set of processes to try to understand and integrate are verbal and non-formalized transactions between workers. Once the non-formalized processes are understood and included in the puzzle, it becomes possible to re-organize the current system and in so doing, integrate these easily overlooked processes. Therefore, rather than

solving problems of poor coordination via information integration, a more logical approach is to alleviate such coordination or service fragmentation problems via understanding and re-organization, and only then consider introducing an information integration infrastructure to maintain the newly integrated work processes.

Unfortunately, certain examples within CSCW research show that management's good intentions often overlook the complexity and potentially negative effects of attempting to impose managerial control over the task chains and individual actors within the production lattice. Management too often sees the finished product without understanding the intricacies of how the various subtasks are coordinated to achieve that final product. This often results in ambitious management goals which may in fact create more work for employees without offering any value return to the individual actors. The actors may in fact resist imposed changes to the production lattice with the result being "technological failure" (Bowers, 1994, p. 288).

When technological failures occur, it is likely that the implementation approach has overlooked critical elements of the working atmosphere, which has in turn caused actors to be resistant. The overlooked critical elements may be social in nature and ought to be considered in order to ease the implementation of an administratively imposed system. More precisely, technological failure may occur when a new system helps the bookkeeping, but actually creates additional or "interruptive" (Ash et al., 2004, p. 106) work for those employees who must regularly interact with the system. Small but important adjustments may be ignored in favor of grander additions which may in fact serve more to complicate that to improve. As an example, consider Grudin's (1988, p. 85) example of an electronic meeting scheduler and the fact that, while it is a good idea in principle, it requires employees to keep their appointment books up to date at all times, so that the electronic meeting scheduler can view these appointment books to find common free time for meetings, etc. Grudin (1988) argues, "Who would benefit from automatic meeting scheduling? The person who calls the meeting: in general, a manager would benefit. But who would have to do *additional* work to make the application succeed? The subordinates, who would have to maintain electronic calendars that they would not otherwise use." About Grudin's example, Bowers (1994, p. 287)

writes, “Grudin argues that, while a manager might see the utility of such an application in alleviating the burden of trying to find time when everyone is free, those who are managed have to do extra work in keeping diaries they might not otherwise bother with. The discrepancy between who gets the benefit and who does the (extra) work is one of Grudin’s three problems which can lead to ‘groupware failure.’ ” Another example of where a misfit of intention and consequence may be seen is when electronic medical records’ goals of “consistency, standardization, structure and completeness” interfere with the timeliness requirements of the medical profession (Hartswood et al., 2003, p. 244). This further raises the issue that computerized systems may in fact introduce the potential for serious errors of the type that would be caught in a traditional paper-based system, but that go unnoticed when made by a computer system. While efficiency may be more important than an occasional error in many fields, errors in certain fields, such as medicine or flight control, may result in loss of human life and, therefore, ought to be weighed quite heavily in any discussion about the merit of CSCW.

Implementation of industry-wide IT solutions may create problems similar to those created on the organization level by over-zealous management imposing IT systems on unwilling employees. For example, in the article “Mission Critical: Challenges for Groupware in a Pharmaceutical Company,” Ciborra (1997, p. 97) assesses the introduction of pharmaceutical groupware applications across Switzerland as difficult due to the contradicting ideals of “streamlining and centralization” versus an individual organization’s desire for autonomy. On the organization level, employees want to maintain their autonomy within the organization, whereas on an industry-wide level, managers and CEOs want to do what they perceive as best for their independent organization. The scale may change, but the problem remains essentially the same. A solution that fits in one organization may not fit as well in another, which raises the further question of what level of standardization is appropriate in a given industry. Pursued without caution, industry standardization may cause the destruction of individual organizations. And on the smaller scale, the introduction of a standard within one division of a company may alienate the uninvolved division(s) and thwart effective company-wide information sharing and communication. Yet despite this risk, one common im-

plementation strategy is to prototype for a representative group within an organization with the intention of then introducing it to the remainder of the organization after successful implementation with the representative group (Orlikowski, 1992, p. 369).

This approach allows the researcher to get close to at least one group within the production lattice, but it also raises the challenge of dealing with human emotion and balancing socio-technical needs. If an actor is entrenched in his job, it is likely that imposing new rules and controls on that employee will create stress and reduced effectiveness. Moreover, when employees perceive that their job security is at risk, they become understandably reluctant to reveal the whole truth about their working routines when they are asked by an outside investigator, consultant, or researcher. Consequently, the data itself may be seriously compromised by the researcher's attempts to uncover what weaknesses exist in the task chains, what shortcuts are typically taken, and what circumventing routines are commonly used. Therefore, on-site observation is an important research tool that can help distinguish real work practice routines from an idealistic recounting of them. "Practice orientation" (Schultze, 2000, p. 4) relies on on-site observation and encourages the development of an information system that tries to unite actual practice with necessary practice, rather than developing a system based on non-practiced idealisms.

In her study of notes implementation, Orlikowski (1992, p. 368) explains that a technology becomes or does not become valued based on early assessments which shape the pattern of usage, and thereby success, for the given technology. Having pointed out that the success of introducing technology aimed at changing organization practices is dependent on changing "people's technological frames and the organization's work practices," Orlikowski (1992, p. 368) raises the important question of how do you "devise a game plan if you have never played the game before." A start is to compose an image of the actual work processes in which employees engage and determine what problems exist in the current organizational system. Only then is it possible to identify and improve the current organizational system such that if the organizational system is remapped to an IT system, current organizational problems will not be transferred in the remapping. Unfortunately,

as Hartswood et al. (2003, p. 241) explain, “What is often lacking is a proper understanding of the nature of what inter-service working actually involves and where the problems lie.”

Clearly, as long as the system remains unmappable to the researcher such that problems lurk behind a mask of intricate routines, flawlessly coordinating the human component and the work requirements of the information system will remain out of reach. It seems that only a bottom-up approach to mapping the established actor-network and production lattice within an organization will make possible the understanding necessary to achieve this coordination.

Chapter 4

Healthcare Quality

4.1 Standardization

The transition of the patient journal has had a long journey from Hippocrates' influence on the medical record during the fifth century B.C. through the modern organization of patient data. Hippocrates used the "time-oriented medical record" wherein medical observations are recorded as they are observed (Bemmel and Musen, 1997, pp. 99–101). The form by which observations were conducted changed over the following centuries, but the format for recording findings remained a chronological one. In fact, in 1880 when William Mayo founded the Mayo Clinic in Rochester, Minnesota, Mayo doctors recorded medical notes in chronological order in a binder which they carried and used for all patient evaluations (Bemmel and Musen, 1997, p. 101). It was not until 1907 that the inconvenience of having individual patient notes interspersed throughout these binders led to the separation of documents into individual patient files, which is the basis for today's "patient-centered medical record" (Bemmel and Musen, 1997, p. 101). However, despite the improved form, there were no established criteria regarding content (Bemmel and Musen, 1997, p. 101). This need resulted in a 1920 decision by Mayo management to establish certain minimal criteria; these criteria established an outline still followed in present-day medical records (Bemmel and Musen, 1997, p. 101). The next level of patient medical record organization—

organization within the individual records—was introduced by Weed with his "problem-oriented medical record," whereby patient problems were defined by the "SOAP structure" (Bemmel and Musen, 1997, p. 102). SOAP is an acronym for subjective (patient complaints), objective (practioner findings), assessment (results and diagnoses), and plan (strategy regarding treatment of the given ailment) (Bemmel and Musen, 1997, p. 102). Of course, one potentially unfortunate side effect of this method is the need for redundant charting—information pertinent to more than one problem must be classified under each individual relevant problem (Bemmel and Musen, 1997, p. 102). Indeed, standardized medicine may be a double-edged sword and there is surprisingly little agreement on the best standard practice for any particular situation (Ash et al., 2004).

Redundancy is by definition a repetition of something already done and in that sense, redundant behavior seems explicitly inefficient. However, Cabitza, Sarini, Simone, and Telaro (2005, p. 158) present two views of redundancy in charting where one type of redundancy is part of standard, intentional practice and the other is unintentional and inefficient. Cabitza et al. (2005, p. 158) discriminate between "back end" and "front end" redundancy; they write, "At the 'back end,' redundancy concerns fault tolerance and reliability; therefore it is usually introduced and maintained. Conversely, at the 'front end,' redundancy typically concerns replication of data or coexistence of correlated data in two or more places." Redundant, or duplicated, information may in fact make a patient journal easier to read, as each section is complete and does not require constant cross-referencing. Duplication in the form of different representations of the same data may improve the system's fault tolerance, but it may also "become unsynchronized or inconsistent and lead to misconceptions or other human errors" (Cabitza et al., 2005, p. 160). The role of redundancy in standardized medical routines is therefore controversial and situation-dependent.

In addition to patient journals, medical standardization may refer to many aspects of medical care, including radiology, billing and other management information, diagnoses reporting, and care-plans. While standardizing routines may have unfortunate side effects, quality assessments of standardized care often find fewer errors than in non-standardized care. Numerous examples exist of healthcare or-

ganizations that have adopted computerized systems, such as patient journal and registration systems, and subsequently seen a correlated reduction in error and improvement in care (Agency for Healthcare Research and Quality, 2000a). Via IT, the consumer and the provider gain immediate access to important patient care information. Of course, IT systems are expensive and incentives may not be clear and compelling. The consumer may gain increased access, but care might be diminished due to the added effort needed to maintain electronic records. An additional consideration is that some facilities within a single region may be better able to afford the upgrade to a shared regional system. For example, in the case of the twenty-nine RWHC member hospitals, advantages of a standard system would be interoperability and the ability to train a rural systems operations task force, rather than maintaining financial dependency on different vendors. Despite clear advantages, there are legitimate concerns such as the redundancy that is built into the SOAP structure's standardization. According to Ash et al. (2004, p. 106–109), unintended consequences of information technology in medicine include the following: an interface that is not suitable for a highly interruptive use context; cognitive overload; oversimplifying collective, interactive work to seem linear, clearcut, and predictable; overcompleteness; (system) inflexibility; workarounds; loss of feedback; and decision support overload.

In a lecture, "Herding Cats? Standardizing Professional Behavior with Evidence-Based Medicine," at the Norwegian University of Science and Technology, Timmermans (2005) addressed care-plan standardization. Though specifically addressing variance of care across the US, such variance of care and lack of standardization is common in healthcare systems all over the world. For example, one issue raised was that some states show unnecessary and longer hospital stays than others for similar ailments. Average length of care is calculated by adding the number of days of care and dividing the total by the number of discharges. The number of "avoidable hospitalizations" in 1998 was calculated at 133.8 out of every 10,000, or 11.5% (Kozak et al., 2001, p. 226), with the meaning of "avoidable" based on whether or not proper ambulatory, preventive, and other care was available such that patients with certain ailments could avoid hospitalization. Given that rural healthcare access is disproportionately lower than urban healthcare ac-

cess (The National Advisory Committee on Rural Health and Human Services, 2006), it seems evident that keeping skilled medical workers in rural areas, as well as improving physical and financial access to rural healthcare, are means by which avoidable rural hospitalizations could be reduced. The number of avoidable hospitalizations in the US in 1998 represented a 5.6% increase since 1980, yet all other types of hospitalizations actually decreased during these eighteen years (Kozak et al., 2001, p. 226). As an example of state and rural variance in clinical guidelines and therefore in number of hospitalizations, consider that certain ailments are treated on an out-patient basis in one state, but require a one-night hospital stay in another state (Bemmel and Musen, 1997, p. 335). Timmerman's argument was that, in general, over-utilization of hospital accommodations represents a larger problem than does under-utilization. Due to variations from one state to another, from one hospital to another, and even from one practioner to another within the same hospital, healthcare legislation has different effects on different hospitals, based on a combination of reasons, among which are hospital and community culture as well as community socioeconomic status. Though product specific, the description by Ciborra (1997, p. 119) of failed groupware implementation is applicable to this discussion; Ciborra (1997, p. 119) writes, "[...] such applications are meeting obstacles in their diffusion, and this is not due to the technology or to the failure of the application. Rather, it is a combination of corporate inertia, entrenched organizational and cultural feuds and limits to learning from innovation that seem to be responsible for the slow deployment [...]" This combination of the social and political as well as the lack of industy standards make for a tumultuous environment for propogating quality and reducing error. The extent to which error plagues healthcare was highlighted by a US government (IOM) report published in 1999.

4.2 Medical Error

The US government Agency for Healthcare Research and Quality (2000b) was a sponsor of the Institute of Medicine's (IOM) 1999 report titled "To Err is Human: Building a Safer Health System." This IOM report led to greater recognition of

the need to improve healthcare quality and prioritize patient safety. The report estimates that approximately $17 billion is spent annually on healthcare costs incurred due to preventable medical error, and all medical errors total as much as $37.6 billion annually (Agency for Healthcare Research and Quality, 2000b). It may be as high as 4% of hospital patients that are injured each year, totalling 48,000 to 98,000 unnecessary yearly patient deaths, and placing medical error related death as the eighth cause of death in the US (Agency for Healthcare Research and Quality, 2000a,b, 2002). In fact, even the minimum of 48,000 medical error deaths exceeds those due to motor vehicle accidents (43,458), breast cancer (42,297), or AIDS (16,516) (Agency for Healthcare Research and Quality, 2002). Medication errors alone are estimated to kill 7,000 people yearly (Agency for Healthcare Research and Quality, 2000b, 2002). Unfortunately, while IT systems may in fact aid in proper medication disbursement, there is equally a possibility for a frenzied doctor to choose the neighboring medication from a group of preselected alternatives, or to inadvertently miss a decimal in a dosage. Errors that would likely be caught on paper disappear and thus become permanent electronically. Medical errors include administering an incorrect medication or dosage, misreading test results, or improper diagnosis due to vague symptoms (Agency for Healthcare Research and Quality, 2000a). Error types include medication, surgical, and diagnostic errors, as well as system failures (Agency for Healthcare Research and Quality, 2000a). System failures are failures in healthcare organization and delivery (Agency for Healthcare Research and Quality, 2000a). The AHRQ writes, "Failures in disseminating pharmaceutical information, in checking drug doses and patient identities, and in making patient information available are system errors that accounted for adverse drug events in over half of the hospitals studied" (Agency for Healthcare Research and Quality, 2000a). When patient data is stored in paper journals, there is a greater likelihood that a heavy workload will result in certain patient journals being absent at the time of appointment (Bemmel and Musen, 1997, p. 99). Paper journals are problematic because they must be retrieved from storage for each use, and when one person is accessing the journal, no one else can do so. If a journal is misplaced or destroyed in a fire, there is most likely no off-site replica of the missing data. In contrast, computerized journals are always accessible to anyone with access, and allow for additional features

which help minimize reliance on human factors like memory, all of which are more fallible than computerization of data. For example, computerized systems may include reminder alerts for follow-up tests and alerts to announce critical lab results. However, such systems may cause healthcare professionals to tire of and ultimately to ignore messages that are "irrelevant or overly predictable" (Ash et al., 2004, p. 109).

Standardization of protocols is another important means by which human error and reliance on human memory may be reduced. For example, another AHRQ-sponsored study found that use of a computerized system resulted in a four-fold increase in survival rate among intensive care unit respiratory disease patients (Agency for Healthcare Research and Quality, 2000a). Decision support systems—for example, the use of MYCIN at Stanford University in the 1970s—are another example of computerization in the medical profession (Bemmel and Musen, 1997, p. 432). Computerization and systems improvement in medical practice organization has been shown to improve patient safety, and is of continuing importance. As is reported by the Agency for Healthcare Research and Quality (2000b), "The IOM emphasized that most of the medical errors are systems related and not attributable to individual negligence or misconduct. The key to reducing medical errors is to focus on improving the systems of delivering care and not to blame individuals." For example, via use of wireless PDAs and bar-coding, one Veterans Administration hospital reduced medication error rates by 70% (Agency for Healthcare Research and Quality, 2000b). It is nonetheless worthwhile to consider the warning of Ash et al. (2004, p. 110) that, "Information systems are on their own not a sufficient fix for the safety problem. A rush toward implementing systems might ultimately endanger the quality of care more than help it."

Part II

Case Study

Chapter 5

Hospital Case Study

The cooperating hospital used for the case study research into the problem presented is the St. Joseph's Memorial Hospital of St. Joseph's Community Health Services, which is headquarted in rural Hillsboro, Wisconsin.

In addition to having a Critical Access Hospital, St. Joseph's Community Health Services consists of a nursing home licensed for sixty-five beds with 24-hour RN coverage and three family practice clinics (with six rotating doctors) located in Hillsboro, Elroy (Wisconsin), and Wonewoc (Wisconsin) (St. Joseph's Community Health Services, 2006). While the approximate population of Hillsboro in 2004 was only 1300 (US Census Bureau, 2004), and St. Joseph's is located within the city limits of Hillsboro, it serves a much larger market area. In fact, St. Joseph's Memorial Hospital serves five counties with more than 18,000 residents (St. Joseph's Community Health Services, 2006). St. Joseph's patient mix represents a demographic in which over 50% rely on Medicare or Medicaid. As an example, for the 2004 fiscal year for heart failure and shock treatment at St. Joseph's, $6,000,000 of costs was attributable to private insurance, while nearly $9,000,000 was attributable to Medicare and Medicaid (WHA Information Center, 2005).

St. Joseph's became my case study site as a result of a well-timed administrative decision to restructure their organizational system via a move from paper to

computerized record keeping. My research is focused on the earliest stages of this process, namely the period during which the established paper systems are reviewed and during which an evaluation is done of nursing staff work processes and needs.

Before proceeding to retell and analyze data collected via observations and interviews, it is useful to make the hospital more accessible to the reader by providing descriptions of both the physical building structure and staff hierarchy, as well as important to provide an explanation of what data collection methods were used and why they were appropriate to the particular setting.

5.1 Staff Hierarchy

St. Joseph's administration is composed of Chief Executive Officer Bill Bruce, Interim Chief Financial Officer Tom Jones, and Vice-President for Clinical Services Toni Tengblad. Additionally, there is a 12 person Board of Directors. The hospital is staffed in three daily shifts, with separate week and weekend rotation employees. In addition to the full-time staff, most pool staff hold part-time jobs in other healthcare facilities.

Involved in the software acquisition process at St. Joseph's are administrators, employees whose jobs will be affected by changes to the present organizational system, and the proprietary software vendors under consideration, most notably American Data, as well as the Rural Wisconsin Health Cooperative, whose interest it is to see rural hospitals become more inter-connected via technology. Figure 5.1 provides an overview of the various groups that affect the ways in which reorganization proceeds, as well as whether and to what degree it succeeds. An important part of the incentive to introduce medical records information systems in medical facilities is the reduction of error, and the common opinion—supported by a wealth of research—that such systems do in fact help institutions achieve this goal. While not an explicit choice, prior to both my and RWHC involvement, St. Joseph's administrative decisions regarding implementation steps mirrored those of Nolan's Growth Model. This model is based on four phases of growth for an in-

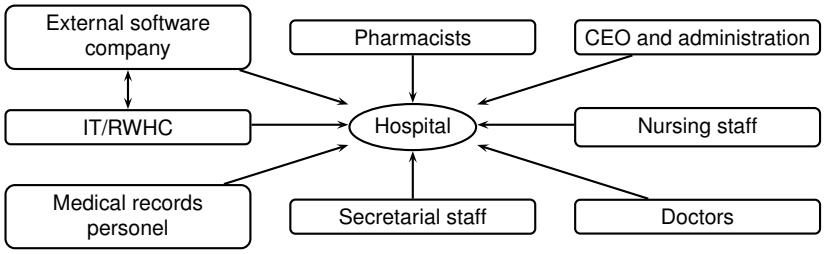


Figure 5.1: Reorganization Actors

formation system—"1. Initiation, 2. Expansion or contagion, 3. Formalization or control, and 4. Maturity or integration" (Bemmel and Musen, 1997, pp. 316–317).

5.2 Floorplan

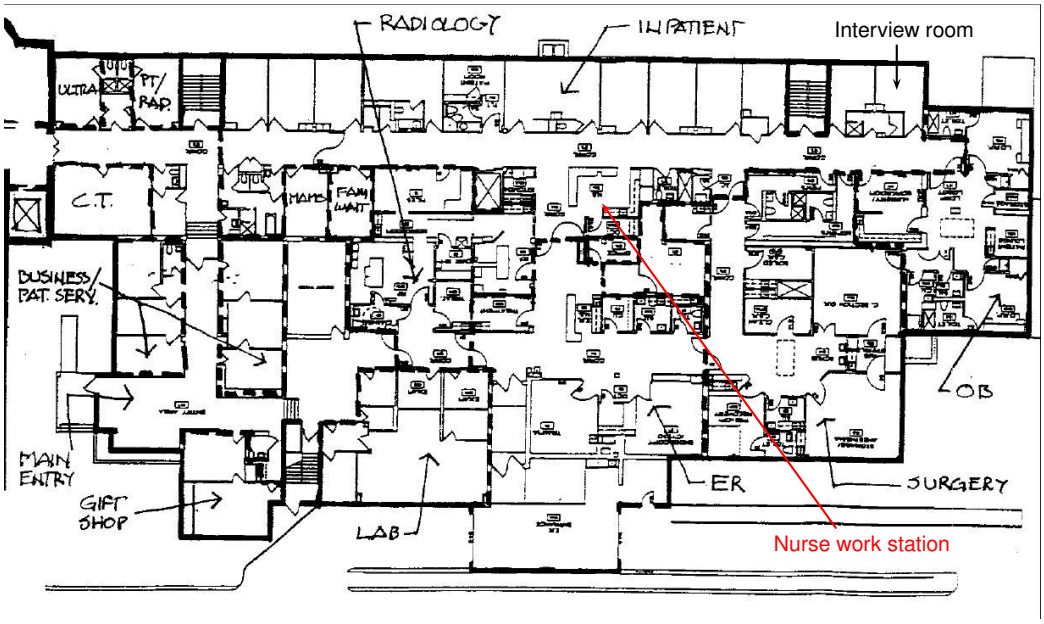


Figure 5.2: Hospital Floorplan

Chapter 6

Methods: Interviews and Observations

In addition to the theoretical methodology, it is important to explicitly describe the practical methods employed during data collection. Sensitivity combined with a constantly questioning approach to interviews and observation were necessary in order to draw out more protected and hidden problematic work practices; ideally, these methods will lead to implementation procedures that may increase social/job satisfaction and ease the nursing-related problems caused by the transition from paper to computerized patient records.

Considering the example of more experienced researchers of situated design such as Suchman and Trigg (1991), I chose to examine specific aspects of the organization of work in the existing paper-based system, then to make suggestions for improvement, and in so doing, hope that changes would be made such that the movement toward computerization was not only better informed, but more appropriately shaped and directed to ensure a higher level of ultimate success. Unfortunately, any potential benefit from this work far outlives the time period for this research, requiring the focus to remain on the present and possibilities. To examine specific aspects of the organization of work in the existing paper-based system, interviews and observations were necessary.

Ghauri and Grønhaug (2002, pp. 49,112) emphasize the importance of a "sampling plan" as particularly relevant when secondary data is not available such that data must be collected via a survey/questionnaire. Also, it is important to set up observations of work practices such that "preconceived biases" may be tested (Ghauri and Grønhaug, 2002, p. 12). It is imperative that a sample group be representative of the entire group. In a larger hospital, it would be appropriate to sample the same number of nurses and nurse-aides, as well as to ensure that different jobs within each category were equally considered (for example, a head-nurse and a regular nurse). In contrast, in the interview portion of this study, it made sense to include the entire group of RNs and their aides, rather than to sample out certain employees. Sampling is, however, an accurate description of my interviews with nursing home staff, administration, and external organizations, like the RWHC and American Data, as well as of my observations within the hospital. In these cases, the most appropriate individuals were plucked out for discussion and the sample's value was based on the individual's association with the software selection and/or implementation process and based on needing representation from each category of knowledge worker associated with the process.

Interviews were conducted with every member of my sample group; in all there were thirty-one Registered Nurses (RNs) and their support staff which included Licensed Practical Nurses (LPNs), Certified Nursing Assistants (CNAs), and hospital clerical staff, as well as senior management, the RWHC and American Data. A small sample of RNs were then selected for follow-up, observation-based interviews. These observation-based interviews of RNs and their interactions with support staff and doctors were conducted over several back-to-back shifts. The interview techniques for each member group within the sample differed according to factors such as whether the group held decision-making authority, how the group perceived me, and whether the group was viewed as holding and perhaps withholding information important to my research. This last distinction resulted in some member groups—such as the RNs—being further subdivided; see Chapter 7.2.1.

6.1 Administration, RWHC, and American Data

My interview methods with hospital administration, the RWHC, and American Data differed significantly from the those used with hospital staff. With the CEO, Vice-President of Clinical Affairs, the RWHC and American Data representatives, I chose to take hand-written notes and had no prepared template. I did have hand-written, bulleted questions which I laid on the table in plain sight of these individuals. My reason for choosing this approach was that my research focuses on the challenges met by nursing and nursing-support staff; and therefore, administrative individuals were of primary use to me for information regarding formal decisions and their practical foundation, such as financial necessity, and operational concerns. Unlike my privacy promise to RNs, LPNs, and CNAs, the members of St. Joseph's administration, my RWHC contact, and the American Data liaison gave permission to use their names and titles. Further, my relationship to these individuals differed from RN and support staff in that I could be described as working for the administration and helping them to cull needed social and operational information from nursing staff. Despite this interest in the same information, administration could ultimately make damaging or terminating decisions about my project which hospital staff could not; and as such, there existed a lower threshold for casual conversation with the hospital staff. In this way, I experienced the administration interviews/discussion as more professionally bound, whereas I felt more like a peer to the nursing staff, due in part to the fact that my interviews with them were mandated by administration, such that both I and my interviewees had pre-defined, specific roles.

6.2 RNs, LPNs, and CNAs

Construction of my interview template for RNs, LPNs, and CNAs was governed by an important aspect of interviewing which is that only questions with variable answers are relevant and should be included. For example, given that the nursing and nursing-support staff varies by age and seniority, but are female with the exception of only two employees, questions about gender related issues within the

nursing staff are less relevant than questions about hierarchical relationships. It is wise to tell staff that their responses will be held in confidentiality; it should be aggregate data which is reported. When analyzing the data collected, it is a good idea to analyze all users together as one group, as well as to analyze them as separate groups by title, in order to find out if there are trends specific to title. In addition to my interviews, my physical presence at the hospital enabled happenstance observation and off-the-record, passer-by chatting. The latter, as well as much to do with my interview technique, falls into the category of ethnographic methodology and is based on setting oneself into the situation rather than critically observing from outside.

In order to be explicit about my methods, it is important to explain that the interviews were structured insofar as I had my pre-prepared interview template (Figures A.1 and A.2). However, I did not show the template to interviewees and was intentionally flexible and allowed some respondents to stray from the template, skipping sections either because there was more to be yielded from a different focus, or because the section seemed less relevant for that interviewee than for another. During this more formal data collection, my methods are best described as open conversation generated from selected questions on the interview template. I chose to use a laptop to record important verbatim responses, so that I could capture a certain amount of personal reflection and, as Schultze (2000, p. 11) describes, "let the people I was studying 'speak for themselves.' " Schultze (2000, p. 11) explains that she made the choice not to record interviews with those with whom she would interact more than once; the reason was to create a less "intrusive" atmosphere, and to foster "continuity and trust" between herself and the interviewees. I chose to have a laptop present and to have the option of recording data, and am of the opinion that touch-typing while looking the participant in the eye helped resolve issues that might otherwise have been present during typed recording of data. Even so, when the conversations became very personal or the interviewee began to hesitate, I would demonstrate friendliness and empathy by placing my hands in my lap, or even shutting the screen. This meant that on particularly sensitive matters, my only notes were mental, or "headnotes" (Schultze, 2000, p. 11), and these had to be typed up later. In fact, in a couple of cases, my

"interview" was more of a personal conversation with me acting to reassure the interviewee of her value to my study. At these times it was beneficial to a supportive, open conversation that I officially dismissed the template and the recording of specific comments, though many of my questions continued to be inspired by my mental version of the template.

I found one technique particularly useful for drawing RNs, CNAs, and LPNs out of a rut and for encouraging them to be forthcoming. My technique was to ask an employee to tell about another, unnamed employee's experiences, practices, and even opinions, rather than his/her own. Not unlike a child lured into telling the truth behind a tall tale, employees were quite ready to say condemning things about work practices of all but themselves, or even about specific other employee traits and interpersonal working skills. I found that after some time, certain social cliques became apparent, as did the common scapegoats and, due to specific comments and knowing what shifts different employees worked, I was often able to piece together more of the story from these individual accounts given on behalf of one another. In other words, allowing employees to construct a protective shield or safety wall between themselves and their statement proved to be a very effective method for gathering sensitive information. My technique finds support in an altered form of this protective shield; work psychology researchers have shown that in the case of interviews, telephone interviews are likely to be "harsher than face-to-face ratings" (Arnold, Silvester, Patterson, Robertson, Cooper, and Burnes, 2005, p. 195). The explanation given—that an absence of visual information focuses the interviewee more directly on the interview (Arnold et al. 2005: 195)—clearly does not hold in my technique, but it is my opinion that the same principle of distancing an interview account from the interviewee is to thank for the success of my technique in drawing out otherwise protected information. And, while these ratings may be harsher, they also seem to be more valid (Arnold et al. 2005: 195); according to Schultze (2000, p. 29) and in terms of ethnographic study, "validity relates to the representativeness of the data and the truthfulness of an ethnographer's interpretation." Validity and reliability may be together referred to as "authenticity," which Schultze (2000, p. 29) describes as one of two minimums of "a convincing ethnographic text;" Schultze describes reliability as

referring "to the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions." In addition to authenticity, the other minimum is plausibility, which has to do with the ethnographer's desk work, or "'write up' phase" (Schultze, 2000, p. 31). Criticality—mentioned earlier in the context of cultural critique—is another important element of ethnographic text (Schultze, 2000, pp. 29–31).

In contrast to my questioning approach during interviews, my observation-based interviews involved long moments of silence where I was either watching the administration and/or recording of care. I was able to see the relationship between administration of care and the record keeping done for that particular service. When staff were directly interacting with a patient, I did not interfere by interjecting questions. I did find that most staff were aware of my presence and therefore offered information about what they were doing while they were caring for a patient. Once out of the patient room, I would observe the recording of data and then begin asking questions. In fact, because of the inherent nature of hospital work, I found that I needed to ask questions almost continuously whenever the staff were not actively aiding a patient or recording data. In this way, I was able to witness patterns of work, but also to get explanations of routines, and answers to questions about those things that seemed like discrepancies to me. Some discrepancies did not have satisfying answers and some work patterns were drastically different depending on which employee I observed.

Chapter 7

Timeline and Stages

The decision to reorganize the hospital's record keeping system was made tentatively in 2003 when St. Joseph's signed an extended contract as a beta-site with software company American Data; their Electronic Chart System (ECS) has had success as a nursing home product, but has not yet been introduced and implemented in a hospital. At the time that the contract was signed, no future installation and "go-live" time estimates were made. In the winter of 2004–2005, St. Joseph's administration decided it was time to begin the process of modeling a hospital-specific IT system. Little forward progress was made in the ensuing months and it was in the late summer of that same year that administration began the push for progress. My research at St. Joseph's began at that time, in August of 2005. With a Face-Sheet graphically modeled and a core group of RNs primed for training sessions, the estimated timeline of events for choices regarding hardware was set for October 2005, and "going-live" was set for January 2006. Initially hospital administration hoped that my research would span the critical period of change from hardware selection through the first months of actual system use. Early timelines are often skewed. Rather than the initially estimated timeline with three distinct stages—pre-implementation, implementation, and post-implementation—my research has been entirely focused on pre-implementation. Therefore, the timeline here referred to is the timeline of my research, which began with pre-implementation interviews on what we all believed was the forefront

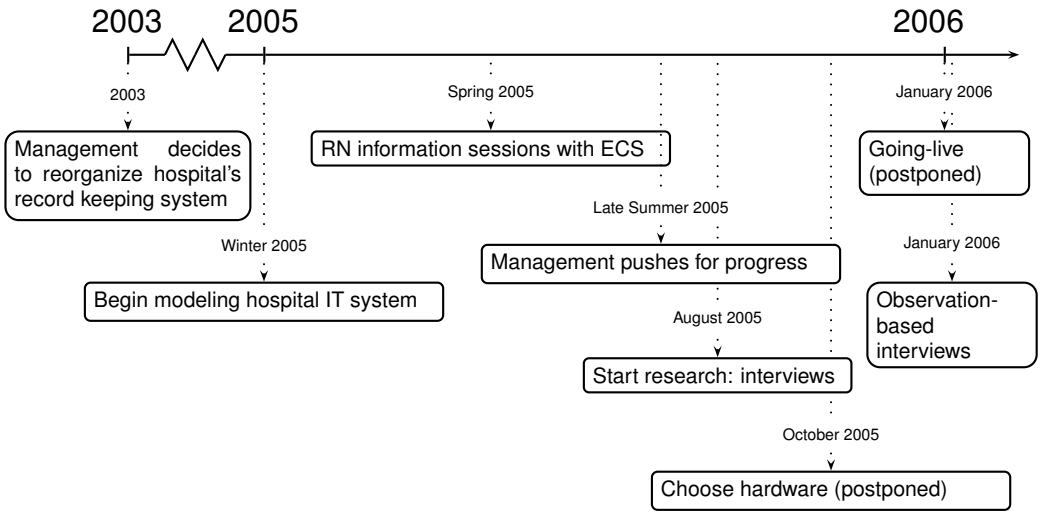


Figure 7.1: Timeline of Events

of a new system, only to be reformulated several months later into a deeper study of the flaws and attributes of the existing organizational system. This reexamination by myself, administration, and IT consultants has been fortuitous as it has actually unraveled the initial process to the point at which not only the timeline came into question, but the IT product with which to proceed has also been brought into the spotlight. The following discussion will therefore start with the work done prior to my arrival and continue from my arrival forward in the chronology that my research followed. Figure 7.1 shows a timeline of events discussed in this case study.

7.1 2003-2005: Software Selection

As described in Part I, in response to trends and concerns based on medical error statistics, hospitals have increasingly begun the move toward computerization and paperless organizational systems. An entirely paperless environment may or may not be better and as Walsh (2004, p. 1185) explains, "Having the option to use

either paper or electronic record output, depending on preference or other clinical constraints, is important." Nonetheless, streamlining the products used in the hospital and nursing home has longterm financial value, especially considering that St. Joseph's does not currently have any staff whose primary duty is IT maintenance. This means that at present any system acquisition would require maintenance by an outside contractor. Clearly there is value to using the same outside contractor for both the hospital and nursing home. Already in use for billing was Dairyland Healthcare Solutions. They offer a comprehensive package for record keeping and were therefore considered in the quest for a better organizational system. Dairyland Healthcare Solutions' applications may be run separately or be integrated into a complete system (Dairyland Healthcare Solutions, 2006). Application options include financial management, patient management, health information management, clinical information management, physician practice, long term care, and home healthcare (Dairyland Healthcare Solutions, 2006). Also considered was Epic Systems Corporation which the RWHC and St. Joseph's administration consider an industry leader; Epic offers an inpatient clinical system, hospital and professional billing, managed care administration, ambulatory and handheld electronic medical record access, scheduling, and registration (Epic Systems Corporation, 2006). Unfortunately, price and the fact that Epic does not currently sell to small hospitals ruled Epic out of consideration. As already mentioned, in 2003, St. Joseph's and American Data made an agreement whereby St. Joseph's purchased ECS for the nursing home as well as for the hospital. The advantage of purchasing a package solution was largely financial, with American Data offering a very reduced price and free training to St. Joseph's; in turn, American Data received a testing platform for the creation of an ECS hospital product. In addition, St. Joseph's pays a monthly maintenance fee which covers telephone support and all uploads and enhancements. Because the relationship between American Data and St. Joseph's extends beyond the formal supplier and consumer, St. Joseph's has had regular contact with the American Data ECS liaison to St. Josephs, Carmen Zirbel (Clinical Training/Support Consultant). While American Data's ECS is still the active choice, both Dairyland and Epic Systems Corporation are once again being considered. The following discussion of American Data's ECS expounds on the post-contractual relationship between St. Joseph's and American

Data, and why ECS is the current, but uncertain longterm choice.

When ECS was introduced into the nursing home, training was done in groups determined by shift, though all training occurred during the day. The training was in addition to regular work shifts. When I asked one night shift employee whether her ability to learn was made more difficult because she would normally be home sleeping during that time, she responded that she does not require a lot of sleep, but that others had trouble adjusting.

The hospital's library computer lab was used as a classroom, with two one-hour sessions with four-five students in each session. One user described these sessions: "They kind of introduced the program and gave us a kind of overall view and basic things, and then we were kind of on our own after that. It all depended on your experience with computers. Once they figured out where our level was, we could move ahead on our own." Asked about her feelings, the user explained: "I thought 'Oh no! Here we go again.' I guess I felt overwhelmed again. [...] But they were really good about not setting deadlines. [...] Their training was very good. We have a good administration. We always knew who to call and if we had any problems or anything, we'd just shut the computers down and try to figure out the problem ourselves." This narrative reveals many problems, despite the interviewee's view that the situation had been a largely positive one. In other words, her experience was comfortable and safe because she received a helping hand in achieving what had seemed impossible in the beginning. However, some of the behaviors glimpsed in this narrative—such as having no deadlines and allowing the computers to be merely shut down in a pinch—apparently resulted in a prolonged and difficult implementation process, beyond the pre-learning phase. The real practice came when the users moved out onto the floor and had to use the knowledge while working. In fact, implementation of ECS in the nursing home was described by several others—ECS, hospital, and nursing home employees—as a difficult process. Many said that it went "badly." ECS's Carmen Zirbel defended against similar problems in the hospital with the explanation that there are "different issues with an acute care setting," and that there were management problems in the nursing home that do not appear to exist in the hospital. Yet one employee with working knowledge of both the nursing home and hospital told me, "I look

at our system and I think 'well how's that going to apply to the hospital?' People aren't here [in the hospital] for a long time. They're just here for a short while. In the nursing home they are there and there and there. You do these things forever."

Despite whatever problems may have existed during training and implementation, three years following ECS implementation in the St. Joseph's nursing home, the number of citations (i.e., violations of Medicaid participation) had been reduced from dozens annually to zero. Additionally, as the St. Joseph's CEO informed me, internal research shows that post-ECS, less time has been spent on charting. That citations were reduced to zero on a recent survey and that less time is spent on charting may not be causally related to the use of ECS. Clearly, if ECS could be properly shaped to fit the hospital needs, then administration could consider the decision to form a beta-site agreement with American Data a wise decision. Unfortunately, reshaping ECS to conform to hospital needs was fraught with unforeseen problems.

One of these challenges was the potential for the American Data liaison to be compromised in her task due to conflicting interests. Zirbel's previous experience as a nurse in rural Wisconsin nursing homes and hospitals provides her with workplace insight and, therefore, an ability to more quickly recognize and understand procedural complaints and software limitations that will lead to employee workarounds. Given the training consultant's previous employment as a nurse, she has her preferred ways of operating, some of which may represent the most valid choice, others of which may not. She therefore risks being biased against imposing organizational techniques that upset traditional nursing organizational systems. As an extension of this bias, she risks being resistant to suggestions made by administration and other, non-nursing hospital employees. For example, she may oppose removal of specific nursing standards, such as recording mental notes on a pocket "cheat sheet" rather than in a computer. In addition to these potential problems, Zirbel is an American Data employee; and though she recognizes the distinct added variables of an acute care setting, her familiarity is with the nursing home ECS product. This nursing home familiarity may limit her objectivity when restructuring the program for hospital use and in particular, when evaluating the system's user-friendliness. In contrast, a perspective external to St.

Joseph's, prior nursing experience, and American Data may more unequivocally identify ineffectiveness by using more objectively reliable and valid techniques.

In contrast to Zirbel's double agent status as an American Data employee and a liaison helping St. Joseph's toward their restructuring goal, the RWHC is interested in the best for rural hospitals and as a separate body can be more objective than the individual hospitals regarding the move from paper toward paperless. The RWHC's focus on rural hospitals—beyond its own survival—is due to the simple symbiotic relationship between the RWHC and its twenty-nine member hospitals; given that these twenty-nine rural hospitals wholly own the RWHC, it would no longer exist if they ceased to exist. This symbiosis is typically quite altered in a consumer-sales relationship, like that between St. Joseph's and American Data. As discussed, conflicting interests are a potential problem in any beta-site agreement. American Data is a separate entity in contrast to the cooperative relationship between the RWHC and St. Joseph's; and therefore, while American Data cannot afford to deplete its customer base and in fact has particular need for St. Joseph's as a beta-site, American Data must still act in its own best interests above that which is best for St. Joseph's. American Data is interested in a good product. But in the end, if the product is sound but fails implementation processes at St. Joseph's, American Data will have what they needed, even if St. Joseph's does not. For these reasons among others, the RWHC has cautioned St. Joseph's about getting too deeply involved with one vendor prior to clearly identifying their needs as well as that which the vendor has to offer. Therefore, St. Joseph's is continuing the beta-site relationship with American Data, and views the opportunity as educational, though not necessarily permanent. Currently the beta-site agreement serves both American Data for obvious reasons and St. Joseph's as an opportunity to determine what needs exist among staff, interoperability, as well as the implications of certain regulations (e.g., HIPAA).

Like the RWHC work, mine is supplemental and somewhat external, with my purpose being to focus on the processes involved in bringing new technology into a previously technology-limited domain. As an outsider, my ability to recognize and share in RWHC concerns is possibly also more objective than that of either St. Joseph's or independent software vendors. Therefore, while I too have a clear

interest in eventual successful software implementation for St. Joseph's, I recognize the opportunity to observe and advise in the beta-site implementation process as a fortuitous one for exposing relationships and conditions that are key to any software implementation success, and particularly those relevant in healthcare informatics. It is my perception that St. Joseph's needs may not be met by American Data despite the fact that American Data has a successful product and well qualified staff. This interpretation will be further explored in Part III. One reason may be that American Data's current success is based on a specific core product that they may be reluctant to alter subsequent to user testing. In contrast, St. Joseph's has been decidedly more flexible about changing their preliminary plan, as well as more open to suggestion/critique. As a result of this open behavior, St. Joseph's improves the likelihood of success in implementation of any system, whether American Data's ECS or another.

The two year period that elapsed from the adoption of the nursing home ECS in 2003 to the fall of 2005 and reconsideration of the beta-site agreement illustrates that the timeline on reorganization is often lengthy and full of setbacks. The first major step toward adapting ECS to the hospital was made during the spring of 2005 when American Data's liaison to St. Joseph's held an in-person ECS-discussion session with self-selected RNs in the hospital distance-learning equipped library. As a hospital ECS demo had not been created and the product itself was not ready to go-live, there were no physical examples or trials available at that time. RN opinions, reactions to, and suggestions for the described system were collected. Over the following months, the Director of Nursing and the ECS liaison worked together to convert a paper Face-Sheet to ECS.

As of early-September 2005, hardware on which to implement ECS was not yet available in the hospital; it was during mid-September that hospital administration held a demo and planned to make hardware choices. In fact, hardware choices were postponed due to concerns about getting locked in to the ECS product, and thereby limiting the hospital's information system options. At this time and still following the initial and optimistic timeline, the ECS nurse admission assessment form was to be introduced with go-live post-training held or taking place during the late fall of 2005. As of September 2005, this admission assessment form was

the only paper-based task that had been integrated in the ECS hospital software.

This uncertainty regarding implementation of ECS bred uncertainty about the best hardware choice. This, combined with a financial setback, caused the St. Joseph's administration to push back the timeline with the intention of picking up the process again at the start of the new year. For this reason, after I conducted my September 2005 interviews with the entire hospital nursing and nursing support staff, administration, the RWHC, and American Data, my selective follow-up interviews were also pushed back to January 2006.

7.2 September 2005: Interviews

At this point in the timeline, my research plan was still viewed as three-fold with pre-implementation only the first stage. Given the administration's goal of identifying whether real problems matched perceived ones, administration was interested in the human component and specifically in gathering the opinions, concerns, and goals of nurses who would be affected by the initial implementation of ECS, or any other reorganization of the current information system. Additionally, the interviews were viewed as a way of revealing work routines that were ineffective or error-prone and which would require consideration during re-organization. Therefore, as explained in Chapter 6, the first important step for me was to interview permanent hospital RNs, LPNs, CNAs, and clerical staff. It was additionally useful to interview pool RNs and CNAs who have previously experienced the shift from paper to computer at other healthcare facilities. In total I interviewed thirty-one St. Joseph's hospital and/or nursing home staff, as well as met with American Data's ECS liaison to St. Joseph's, Carmen Zirbel (Clinical Training/Support Consultant), Rural Wisconsin Health Cooperative's Director of Health Information Technology, Louis Wenzlow, St. Joseph's Vice-President for Clinical Services, Toni Tengblad, and St. Joseph's CEO, Bill Bruce. Please see Figures A.1 and A.2 for the Pre-Implementation Interview Template that was used only with the nursing staff.

During the two weeks that I conducted interviews in the hospital wing, I was

given the use of what would otherwise be a break room. The purpose of having this room was that it was small and private, and I could shut the door during interviews. There was a phone in the room so that I could make calls necessary to my project. The only time period during which the room could not be used was directly preceding morning rounds, as the nurses needed to use the room for preparation and the morning updates. The break room is across the hall from the OB-GYN section of the hospital. Given its proximity and the relative quiet of the OB-GYN section compared to the rest of the hospital, during the time that my break room office could not be used, I was able to use the waiting alcove in the OB-GYN section. This room was relatively private, despite having no door to signify true privacy to the interviewee. In fact, the OB-GYN room had couches instead of a table and chairs and, despite the lack of official privacy, offered a more comfortable space which seemed to relax interviewees. Unlike the break room, interviewees did not have to enter the room to determine if they were where they were supposed to be—instead, they could casually approach and could size me up before we were facing one another across the table. Moreover, the OB-GYN room allowed me to calmly and quietly observe more interactions among staff and between staff and patients than I could in the break room. Despite the unobtrusive approach to my interviews, there were those who were inclined to withhold information and would clearly have opted out of the interview had they been given the choice.

Rather than allow for self-selection, administration operated on the assumption that all would participate. A couple of days preceding the start of my interviews, a notice was hung in the staff room informing the staff that their cooperation was requested in the hospital's participation in a research study on the topic of "Implementing an Electronic Medical Record in Nursing." The formulation of the memo as a request for cooperation was an administrative kindness; in fact, I was to interview all RNs, LPNs, CNAs, and unit secretaries, regardless of whether they were interested in cooperating or not. This is an important feature of my research because it meant that I received information from various user-types—those that might not have signed up voluntarily—and I received very different reactions regarding my presence. The memo included the information that I am the daughter

of a hospital board member, who is also chair of the Mission Committee. Before my interviews started, my own reaction to staff knowledge of this fact was mixed. On the one hand, providing the information seemed like a good idea given that, had it not been provided and staff had become aware of the fact, they might have assumed me to be an administration spy and therefore been reluctant to share job-related details. This might be especially true of those that cast themselves or others in a negative light. Moreover, that the information was provided allowed me to directly tackle any misconceptions about my role and allegiances, and thereby to dispel fear that I would be leaking information, and particularly information attached to a name, to the Board. However, I was also aware that due to the information being open, I might face more of a struggle to be taken seriously, and that as a result, I would have to be more convincing than a true outsider in order to prove that my opportunity was due not only to having the right contacts, but also to merit. In fact, my fears regarding the memo were largely assuaged by reactions of those who had read it, and more markedly, by the fact that very few had read it or even knew what I was doing there beyond hearsay from others who had been interviewed by me. Moreover, while a few employees clearly viewed their interview as an ordeal and a waste of resources aimed at helping me without offering anything to the hospital in return, most employees recognized that my project could have beneficial results for them—their opportunity to really be heard—and therefore, they saw the project and their participation in it as worthwhile. Some were even hopeful that I would follow-up with them at a later stage, in order to again provide an outlet for voicing concerns.

The self-selected RNs from the spring 2005 ECS presentation indicated high motivation to be involved in the upcoming process, as well as comfort in using a computer. Those that indicated willingness to computerize their current skills inadvertently also indicated that they were comfortable and familiar with proper work routines. The result of staff self-selecting themselves was that the spring 2005 meeting saw a more elite group making suggestions about future changes and reorganization. It was equally clear that employees who were uncertain of routines or had weak computer skills were more likely to withdraw from situations where their lack of knowledge and skills might become embarrassingly

apparent. There were no such employees at the spring 2005 meeting. However, when faced with obligatory interviews, these employees could not withdraw and, interestingly, when I questioned this larger selection of staff, I received several concrete program suggestions, and understood that too few had been represented at the spring 2005 ECS meeting. When asked, staff gave a range of reasons for why they chose not to get involved. The lack of involvement of staff with weaker computer skills or those who were reluctant to participate, whatever the reason, exposes certain problems, especially that of encouraging timid users and of uncovering inefficient work routines. It was particularly apparent that some of the timid computer users had withdrawn from the spring ECS meeting out of a sense that they had nothing to contribute or that their feedback would be worthless; had they even understood at the time that the viewing would not require anything of them in skill, they might have withdrawn due to this feeling of having nothing to add. I found that comfort with computerized charting was not only correlated to age, but to the time elapsed since formal education, and whether St. Joseph's had been the interviewee's only employer.

7.2.1 Categorizing the Human Component

As might have been expected when bringing an outsider into any work place—and particularly so in one so geographically isolated and in a profession so tuned to privacy—the majority of employees required several minutes to warm to the situation. Many hesitated and initially replied with cursory answers. For this reason, after my first day of interviews, I reworked my interview template to include some general early questions that were unthreatening and calming. Employees varied a great deal in their willingness to talk to me; some were indifferent, some eager to share their ideas and pleased to have the audience of someone interested in the process which was to affect them. And of course, there were also those that resented my presence and the administration's expectation that they grant me an interview. I was happy for the variance, however. As Winthereik, de Bont, and Berg (2000, p. 55) write, "'Good' science [...] challenges pre-set assumptions. [...] Without resistance, or what Latour calls recalcitrance (Latour 2000; Latour

forthcoming), the researcher is unable to transform her initial questions, and will merely reproduce well-known insights." For this reason, it was particularly important to me to collect information that showed the spectrum from an individual employee's rational, knowledge-work based insights to his or her emotional reactions; this three-fold version of the user consists of the "cognitive, conative, and affective" (Elsom-Cook, 2001, p. 94). In fact, I learned a great deal from each category of employee, as their hesitations, body language, and side comments gave insight into different potential implementation problems, training needs, and program preferences.

There were four distinct employee types, with a few interviewees falling into more than one category: lacklustre, timid, confident, and eager. Lacklustre employees were the smallest group and the only disagreeable one, characterized by a critical mindset that an outsider should not be permitted to know about work routines, and especially not about errors or poor routines. Timid users were characterized by their initial reluctance to share information, not because they had nothing to share, but because they did not know what to share. Confident employees were characterized by their straightforward telling of the negative and positive work routines at St. Joseph's; this group seemed confident that their jobs were secure and were ready to help improve St. Joseph's. Eager employees were a refreshing group given that they were very engaged in the process and truly eager to help St. Joseph's and to help me in the process; however, this group's willingness to brainstorm often led to unrealistic wishes which quickly became "needed" rather than "desirable" features of a new organizational system.

The Lacklustre My presence in the break room in between interviews meant that, if I were alone in the room and working on my computer (fixing notes from my previous interview), some were uncomfortable sitting in the room or even entering to check their mail boxes. Others were unphased and would merely sit down to take their break—whether to chat a moment with a colleague or to have lunch. And a few seemed to pop in to say hello to me, to find out if I was learning anything useful, and to try to offer more information that they'd forgotten during their interview. In fact, respectively, the behavior upon finding me was

either timid, confident, or a curious mixture of timid, confident, and eager. It was only Lacklustre Group employees that unfavorably distinguished themselves, once again drawing clear lines in the sand. An anecdote from the Lacklustre Group will explain why this group, disagreeable as they may have been, was important to consider—from their perspective. One afternoon I had a steady stream of interviews, but one of the early interviews had to be rescheduled which affected those who were to come after. While I was waiting for my interviewee to arrive, two employees entered the break room with their lunch trays, sat down, and began discussing me and my project—as if I were not there! They were referring to the project and whether they had yet done their interview with "that girl," etc. I had interviewed the one woman already and had deduced that her harsh and resistant responses had more to do with fear over job loss because she felt inadequate. I was curious and wondered if I should just ignore them as well. After a bit, the one I'd not yet met asked me if I intended to sit there throughout their lunch—and biting at the urge to ask if they intended to sit there through my interview—I smiled and said that no, I would conduct my afternoon interviews in the OB-GYN room. At this point I was informed that I needed to respect the environment into which I had entered, that the room was the "only" room in which they could eat lunch and that I would have to work around the hospital already in place (there is, by the way, a very nice cafeteria and dining area in the hospital just a few steps away). Being pressed to know my place was a good reminder that I truly was an outsider and was therefore confronted with quite a great challenge in order to gain insight into work place operations and knowledge.

The Timid My typical first impression of this group was that they were physically withdrawn and overtly fearful, timid users. In fact, the first part of my dialogues with this group tended to follow the same pattern for each member interviewed. The initial conversation went as follows:

> **Me**: "Hello."
> **Interviewee**: ⟨nervous nod⟩
> **Me**: "Before we get started, let me tell you a little bit about why you are here and why I would like to talk to..."

> **Interviewee**: ⟨cutting me off⟩ "I don't know why they have you talking to me. I don't know anything about computers, so I can't help you."

What was apparent from this defensive reaction and the discussions that ensued with this user-type was that some of the quieter, more timid users can provide a perspective on what is intimidating about a new organizational system, particularly one on a computer. They were also able to make guesses at what might be comforting, given that the move toward computerized charting is not up for discussion. Many seemed to react to the fact that the decision to use ECS had already been made and as a result they had resigned themselves to just get with the program, but had a clearly defeated physical look. This group is valuable in helping to make the system usable to the majority of users rather than merely the confident and capable ones. Once the initial moments of hesitation were past, unlike the Lacklustre Group, the Timid Group users were ready to talk about their own shortcomings. They were very concerned that personal shortcomings would cost them career success, yet were readier than the Lacklustre Group to make necessary adjustments and to undergo training to limit the perceived gap between themselves and higher achieving co-workers. Despite a pervasive lack of personal confidence, the Timid Group was seemingly unconcerned about job loss and definitely more inclined toward personal progress than the Lacklustre Group. However, like the Lacklustre Group and despite feeling secure in their jobs, this group was very concerned about confidentiality; and as a result, they took a long time to warm to the situation. But unlike the Lacklustre Group, this group did eventually warm to the situation, though they often maintained that they had nothing valuable to share. An anecdote about this group shows how it was that this group provided some of the most important information to my research. Each interview with Timid Group employees began with the description given earlier of timid users, where the users entered the room already deep into an apologetic statement that they could not understand why they had been asked to speak to me, and that they could be of no use to my research. Yet this was far from true; in fact, it was this group that had the most members, as well as some members from the Confident and Eager Groups that could identify (when explicitly asked) with many of the same fears

and concerns expressed by the Timid Group users. And, it was this group that was most in touch with exactly what was at the root of various insecurities, both personal and interpersonal. For example, this group did not merely explain themselves as phobic of technology or computer-incompetent, but explained that they had never become comfortable on a computer due to specific causes, such as an inability to type, undeveloped spatial skills required of a mouse, and/or a lack of experiences that provided support for using a computer rather than a pen and paper. They were more aware of the different levels of users than were any of the other groups, and could also identify with responses that were quite different from their own. Beyond computer basics, this group recognized potential problems of using computerized charting, such as patient comfort (particularly among the middle aged and elderly), privacy concerns (HIPAA compliance), and concerns over time spent charting versus in active patient care. Most notable about this group is that it contained no RNs. Perhaps a result of their hierarchically high status among those interviewed, RNs did not come across as timid, though some came across as obstructive and uncomfortable with my presence, placing themselves in the Lacklustre Group. Most RNs fells into the Confident Group, with only a few in the Eager Group; I attributed this to a greater sense of job security as a result of being harder to replace, as well as to greater involvement in the decision-making process due to higher hierarchical value to the institution.

The Confident Though the name is very positive and many of the work-related traits of this group were indeed positive—a high work ethic, interest in doing a complete and error-free job, and patient safety and quality as a top priority—this group was also most likely to identify job related problems with weak and lazy employees or faulty administrative rules, rather than with ingrained practices, such as the nurse "cheat sheet" or other handwritten notes. For example, several RNs informed me that those that had participated in the ECS viewing during the Spring of 2005 were the more conscientious RNs and that those who had not participated were uninformed due to a tendency to avoid staff meetings and to generally be disconnected from their work environment. While some RNs in the Lacklustre Group did seem both uninformed and lazy, others were among the best informed

of all user-types regarding who I was and why I was conducting interviews. An inescapable conclusion is that these individuals had not participated, not due to lack of information or a disconnection with their work place, but rather due to disinterest and possible social discomfort with their collegues. The Confident Group may be further divided into two sub-groups: full-time hospital employees and pool employees who typically worked more of their time at other facilities. It was difficult to attain quality information from the full-time Confident Group because, as with most members of the Lacklustre Group, some members of this group viewed my relationship to the hospital as purely one-sided, with me gaining and the hospital merely acquiescing to my research in order to help the daughter of a board member. In contrast to the full-time members of the Confident Group, pool employees did not view my involvement negatively. Rather, members of the pool group tended to be more detached and their confidence tended to spring from ability and experience rather than hierarchy. Comparing their St. Joseph's experience with work in other hospital settings, this sub-group recognized problems and were aware of the need for change and improvement in operations, and particularly in paperwork organization. As a result, this faction of the Confident Group viewed my involvement as important and overdue. Regardless of sub-group, nearly all members of the Confident Group had a very supportive view of information systems in medicine, and were so adamant that they could have supported an ad campaign for any medical-IT company. This support was based—in general—on experience and personal examples from other hospitals rather than on pure opinion, which made it quite valuable to me as an outsider to medical practice. It allowed me to understand in context and via first hand accounts what I could otherwise only read in other case studies.

The Eager My interactions with this group were distinguished by the similarity to a casual, even friendly conversation about something of intense interest for the researcher and interviewee alike. This group represented both savvy and hesitant users who struggled to distinguish between wants and needs. Some of the most exceptional ideas came from this group, but they also tended to gain momentum, and simple, good ideas became overdeveloped and too complicated. What

made many of the ideas exceptional in their original conception was their simplicity. Members of this group were the most enthusiastic about and likely to add to computer-interface related suggestions for how to ease an eventual transition to a computer-based system. For example, when asked about a color-coded tab system that would replicate the widespread color-coded system used in paper-based patient journals, the idea that the computerized interface could be familiar rather than intimidating was a huge factor in their enthusiasm and desire to push further with the idea. I encountered a similar response when I asked whether a UPS- or FedEx-style computerized patient signature tablet could be used to circumvent such a problem as requiring a patient to sign three copies of the same document. Whereas the negativity of the Lacklustre and uncertainty of the Timid tended to limit their creativity, the Eager were very creative, but lacked clear boundaries about what might be appropriate in any information system. The creativity showed in discussing changes to the information system was also evident in discussing educational options for how to teach new software. The individuals in this group are easy to like and seem naturally friendly with other staff. They possess a peer-type leadership quality that makes them a group that could likely help gain support for new initiatives, as well as a group that is in touch with staff opinions of administrative initiatives and not afraid to share and discuss potential improvements and changes to such initiatives.

7.2.2 Human Fears and Quality Concerns

The extent of concern over reorganization and particularly the prospect of electronic organization was determined by the level of competence the interviewee felt in their current job. Regardless of employee type, most viewed electronic charting as a means of disciplining employee behavior (Winthereik et al., 2000, p. 49); it was only the opinion of whether discipline was needed and/or appropriate that differed from one employee type to another. Those employees that could give clear descriptions of proper routine tended to prefer a new organizational system, and particularly one where they felt rule discipline would be a key feature. Those employees who forgot steps or gave varied explanations of standard

routines were more concerned that a new organizational system would not only be difficult to use, but that it would catch them in errors. The most common concern regarding changing organizational policy was of having one's actions tracked and stored by the computer. This concern was voiced directly as well as in connection to an apparent concern for the hospital. Both legitimate concerns about job protection as well as concerns about being caught for improper conduct are common fears in the introduction of new systems. There was an interesting divide between those workers whose principle concern was clearly St. Joseph's or patient welfare and those for whom this raises concern about their job. A good example is the reaction that occurred when time-stamping was introduced at St. Joseph's in early-2005. Time stamping involves employees clocking in and out of work when they come and go. It was met with two very dissimilar responses: a view of time-stamping as either unacceptable or legally comforting. One RN drew an analogy between the "security" of paper time cards and a common preference for continuing to use paper patient journals. When the electronic stamping system was introduced, some employees apparently continued to carry around a paper version of their time card because they were not able to access the internal information and were concerned that their hours would be incorrectly recorded. This demonstrates one form of technophobia, which refers to a fear of using unknown or modern technologies. In fact, technologies may indeed be initiated as control mechanisms. The electronic timecard system provides a good example; it not only ensures accurate reporting to billing, but it acts as an electronic policeman and encourages compliance with showing up on time for work. As Akrich (1992, p. 218) writes, "Some techniques move closer to 'social control.' They establish norms and punish those who transgress them [...] The penalty for breaking the rules—rules that are both social and technical—is immediate and abrupt [...]" To make the situation more personally clear, this nurse added, "I'm very visual. If I want a map to your house, I don't want to look at 'MapQuest' [i.e., MapQuest.com], but at a paper version." Unfortunately, paper versions allow changes to be made to reflect what should have been rather than what actually was, and while staff may be fearful of this, it is in fact a rather necessary control mechanism, especially in healthcare where fudging the details can be a life or death issue. As Nordenberg (2000) writes in the article "Make No Mistake: Medical Errors Can Be Deadly

Serious" in the Federal Drug Administration (FDA) Consumer Magazine, "Even the seemingly simple process of giving a patient medicine—the right drug, in the right dose, to the right patient, at the right time—is, in reality, teeming with opportunities for error." At St. Joseph's, the greatest concerns came, however, not from the fear of being tracked or even of serious error, but from a fear of being expected to accomplish more, and even that ECS might render certain jobs unnecessary. Another typical fear was inability to do one's job due to malfunctioning or poorly understood technology. Yet, even a fear of losing data fell against a backdrop of personal concerns. That a backed-up computer copy is more secure than one copy of a paper journal is not sufficient comfort because the principal fear is that losses will be traceable; for a majority of those concerned about loss, the loss is of secondary importance to blame. Even for those for whom blame was not a focal issue, and who are proponents of the flexibility offered by a paperless system, there is concern about back-up and tangibility. Many expressed concern about the ease of viewing records, and whether it would be possible to access a computer when needed. One RN told me that if she has to walk down the hall to input information, she won't be doing that. But she did say, "I'd be more inclined to put info in right away just because of ease of accessing information. It'd be like carrying the chart in with you and having the ease of charting and you can't [carry all paper charts at all times]." Even if computers are easily accessible, fast login access is another area of concern. Many were bothered by the number of login screens necessary for accessing Dairyland Software. As one staff member told me, "I don't want it locked up so tight that I have to enter a password and go through five screens. And now [for bedside charting] you don't have to just do that for one patient, but for every single patient." Lastly, beyond personal fears of either being caught not doing one's job or being unable to do one's job due to glitchy technology, there were those who expected a negative patient reaction. The concern was that patients (especially elderly ones) will react negatively to bedside charting. Interestingly, this concern seemed to be a projection given that it was most prevalent among the weaker computer users, also those who would likely react negatively themselves. Many of these users had in fact referred to my laptop as "that thing" and while they all approved of my using it during their interviews, they were clearly uncomfortable with its mere presence. This is a

particularly clear example of the technophobia present in many of St. Joseph's employees (particularly in the Lacklustre and Timid Groups).

7.3 January 2006: Follow-Up Interviews

My January 2006 hospital research is best described as selective extensions of the interviews I conducted in September 2005. In addition, I conducted follow-up interviews with each of the CEO, the Vice-President for Clinical Services, and the RWHC's Director of Health Information Technology, plus observed St. Joseph's monthly HIPAA meeting.

Rather than merely re-interview a selective group of RNs, it made sense to allow them to use props to show me in detail what some of them had struggled to convey during our previous interviews. This in practice meant that much of the two-three hours spent interviewing a given RN involved pauses and observation while she worked directly with patients. However, while walking between patient rooms or in the quieter hours, the time allowed for the RNs to give me examples in the form of paperwork or even showing me where papers are stored, placed when filled out, etc. As I am not acquainted with or educated in nursing or hospital routine, this hands-on visual observation proved a great supplement to my understanding of what was explained to me in the condensed September 2005 interviews. Because I had interviewed the entire group in September, I was aware of and ready to ask about the many different perspectives and explanations for various work routines. In addition to getting many of my questions answered, these follow-up interviews allowed a broader spectrum of staff to clearly and explicitly describe their work routines. For those RNs and support staff whose command of language is weaker than their command over the demands of their job, this blend of interviewing and observation provided them an opportunity to better express themselves via use of such props and hands-on examples. Structuring this round of interviews in this way clarified the September 2005 interviews. I was thus able to determine what was actually done rather than what I was lead to believe was done. In other words, this eliminated some of the self-protective and secretive

elements that had held certain information at bay in my interviews with all the employee types, though particularly with the Lacklustre. For example, I was curious to see whether dictation machines were actually used and whether the RNs recorded their meetings with one another. My suspicion was that recordings were at most rarely used for either dictation or meetings; this was one of the discrepancies that the seemingly more reliable interviewees had not asserted, but that the Lacklustre had. Indeed, recordings were not used once nor was the equipment ready for transport to where meetings occur. The Lacklustre seemed to have spun a tall tale to comply with what sounded like better practice.

The Director of Nursing believed it was best for me to be on-site in the hours leading up to and following shift changes, and that I ought to be assigned to shadow a specific RN during each visit. The reason for assigning me to the hours leading up to and following shift changes is that these are the times when staff record the majority of the patient information from their shift, as well as when they are reporting to the next shift. Also, by including two hours of a normal shift, plus the end and start of shifts, I was able to get a more complete understanding of what happens at various times throughout any given shift. Rather than three daily shifts like what had existed in September 2005, in January 2006 the hospital was operating with only two daily shifts and the Head Unit Coordinator departing at 3 PM rather than 6 PM as previously. In order to accommodate being present at the start and end of shifts, I arrived at 5 AM each of three days, departed in the mid-morning, returned again at 4 PM, and departed again around 9 PM. In this way, I was able to observe the "morning meeting" where the night RN and her support staff would brief the incoming two RNs, then again in the evening when the two departing RNs would brief the incoming night shift. Also, I was able to see how information was passed along in the hospital—when the morning RN shift would take over, I watched the morning nurse report, then watched as one of the day shift RNs reported to the doctors for "Grand Rounds" what she had learned from the night shift. Grand Rounds is the doctor's daily update meeting and is held each morning at 8 AM. I took notes during both the nurses' and doctors' meetings. Comparison of these notes provides a good indication of the reliability of the purely verbal communications that supplement the more official paper

communications.

7.3.1 Work Routines

Prior to describing specific incidents and work sequences, it is useful to provide basic information concerning the nurse work station and the work done in this room. The nurse work station is the locus of paperwork flow and where communication between the hospital wing and other departments occurs. There is only one employee whose job is to stay in this room. That is the Head Unit Coordinator (HUC), or hospital secretary. She is positioned in front of the phone and the only personal computer in the room. Not once during my time in the hospital did I ever see her or anyone else use the computer except for a non-job-related Internet search. It is apparently sometimes used by the night staff for playing music, and occasionally by the HUC for memos, but its primary function is as an Internet terminal. There are an additional three chairs with desk space in the room. At most times there were employees occupying at least two of these spots, whether filling in forms or having an impromptu meeting with one another. The morning and evening shift change meetings which will henceforth be called "nurse report(s)" were held in this room. Because nurse reports occur when the HUC is off-duty, the nurses have to be present to answer incoming calls. Additionally, there may be people coming through the ER doors during hospital clinic hours, as well as patients needing assistance. When there is no other staff present to come find a nurse in such a situation, it is necessary for them to hold the nurse reports in this public space. Of course, this also means that they must be very cautious in what they say and how loudly they speak. Within the work station is the separate "Dictation Room" which is only rarely used for medical records transcription and mostly functions as a coat and handbag room for on-duty staff. The room has a door into the work station and from within the room the telephone, radio, and patients can be heard. Yet, the room itself offers a barrier of protection for more private conversation. It therefore seems that this room could be even more multifunctional, additionally serving as a nurse meeting room. For now, the nurse report at shift change remains in the open area of the nurse work station. Figure

7.2 shows a diagram of the nurse work station and Figure 7.3 shows a picture of the nurse work station.

Nurse Cheat Sheet During the nurse report at shift change, the incoming RN refers to and copies numbers out of the "Nurse Notes" section of the patient journal. In addition, nursing staff keep a nurse report sheet, which most nursing staff refer to as the "nurse cheat sheet" (Figure A.8) and which is updated throughout one's shift and which should correspond to all other cheat sheets. In order to correspond with one another, someone has to periodically update the main cheat sheet which is kept at the desk by the HUC in the nurses' work station. Figure 7.4 illustrates the work routines associated with ideal use of this artifact.

As the blanks indicate, these sheets function as a shift-long, temporary record of each patient's necessary records such as intake, output, and vitals. In the "Other Comments" section, some nursing staff also took notes regarding non-medical issues such as patient emotions, family visitations, etc. Though the cheat sheets should correspond to each other, they are in fact highly personalized. For example, during nurse report, two people might record information for one patient using different note taking styles to record different aspects of the same information. During one nurse report, the LPN present primarily wrote information pertaining to the emotional problems of a particular patient, and pressed the conversation to discuss this patient's need for more family visitation, etc. In contrast, the RN focused explicitly on physical data, though it was clear from the discussion that both assumed a relationship between the emotional and physical. When asked why the information recorded on the cheat sheets was so different, the RN explained that each person filters the information through a lens of importance based on job role. Nurse report also offers a time for handwriting and shorthand to be deciphered before shift change. During nurse report, those routines requiring records and necessary for all patients are discussed on a patient-by-patient basis. These routines include preparing a Face-Sheet and an "Admission Assessment" upon arrival, administration of medications, recording intake (food, liquid) and output (feces, urine, vomit), and keeping a charge sheet.

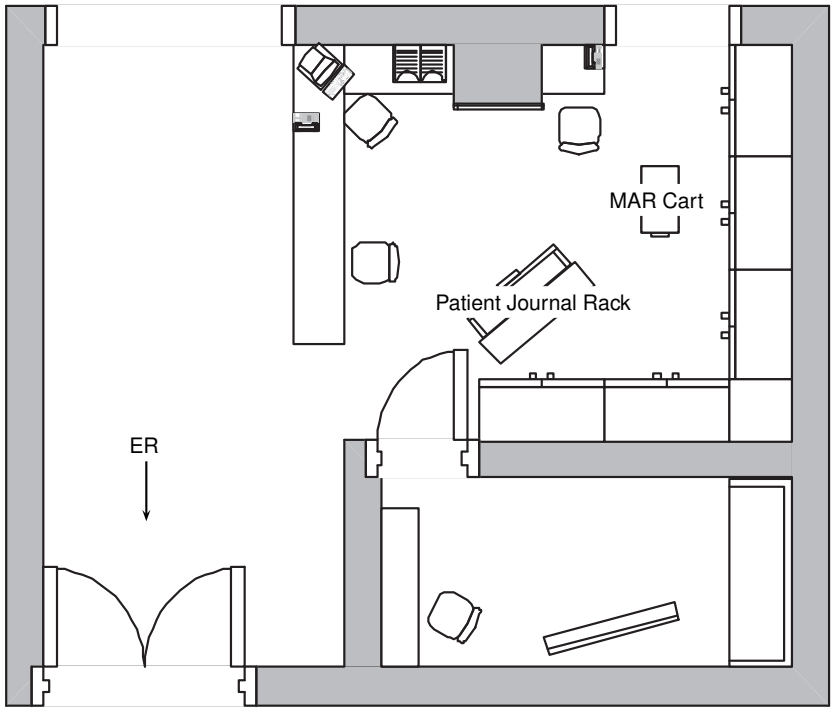


Figure 7.2: Nurse Work Station Floorplan

Figure 7.3: Nurse Work Station Picture

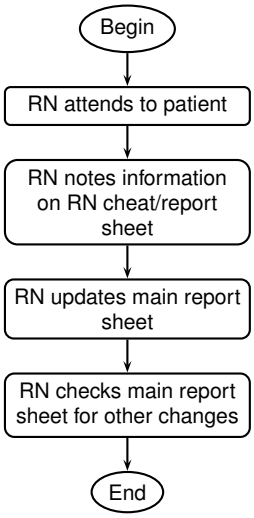


Figure 7.4: Nurse Cheat Sheet

Face-Sheet and Admission Assessment The admissions process involves many standard procedures and paperwork. A description of the admissions process follows and is illustrated in Figure 7.5; note that administrative paperwork like the Face-Sheet or Patient Registration Questionnaire may be completed prior to completion of the admission assessment form and as such, the top and bottom halves of the task chain may change places. The nursing work assosicated with admission is made up of the nursing assessment, followed by a 24-hour patient care flow sheet, and completion of a care plan. At this point, the patient is officially admitted and provided with an identification bracelet. All ER patients must be seen by a doctor. The physician work associated with admission includes making admission orders that will be copied to the Medication Admininstration Record (MAR) and taking the patient history and giving a physical. At admission, the Face-Sheet must also be completed. During the front desk business hours of 8 AM to 6 PM, the front desk prints the Face-Sheet for the nurses. The Face-Sheet is a general registration sheet which may be printed from Dairyland if the patient has previously been a patient at St. Joseph's. However, Face-Sheets include financial information and may only be printed by staff working at the hospital's front desk. If a patient comes in outside of the front desk hours, the nurse handling patient admission gives the patient the Patient Registration Questionnaire (Figures A.5 and A.6) which allows the nurse to generate a modified form of the Face-Sheet.

Additionally, a temporary patient number is given until the following morning when the front desk staff return and are able to print a complete Face-Sheet and assign a permanent patient number. A patient's number never gets re-used, even after the patient dies. The numbers are 5-digits; the first number ever given was 00001. Social security numbers are not used because this causes a problem when a person is dead or comatose and there is no identification on the body.

Though the admissions assessment (Figures A.3 and A.4) contains most of the same information as the Face-Sheet, it is a medical rather than administrative form. In the ER, the admissions assessment is filled out by an RN and then left outside the patient's room for review by the doctor.

While preparation of both the Face-Sheet/Patient Registration Questionnaire and nurse admission assessment involves redundant work given that they contain much of the same information, they serve different purposes and are stored in separate systems. Though the Face-Sheet information is stored in Dairyland, the actual print-outs of both the Face-Sheet and admission assessment are stored as paper files. Face-Sheets are stored at the front desk for monitoring whereas admission sheets are filed into the patient journal for every visit to the ER. In addition to the Face-Sheet and admission assessment, most of the general information such as patient name, address, age, gender, evaluating RN and physician is copied a third time into the "Emergency Room Register" (Figure A.7).

Medication Administration Record (MAR) After a patient is admitted and begins treatment, one of the most important records for that patient becomes his/her record of medication which is stored in the MAR book. The MAR book (Figure A.9) is at all times kept together with the medication cart. In addition to the MAR for a given patient, each patient has a drawer on the cart and notes from one shift to another, as well as extra medication in a syringe, etc. may be left in the patient's drawer. It is up to the next shift whether they use what is already opened and available in the drawer.

At night, orders often occur more quickly because doctors in the ER tell RNs about orders rather than informing them via the HUC. There were quite a few complaints

about the time taken during the day between when a doctor makes any order (medical, changing of intake and output readings, change in observations, etc.) and when the order is discovered and processed by the HUC. Figure 7.6 illustrates the medication ordering process for orders written by the doctor. In the event that a doctor is not present or is occupied, an RN can take both telephone and verbal orders. The order must, however, be co-signed by the doctor prior to changing patient care. It is important to note that if a medication order changes verbally, the RN may make the update in the MAR, but the original doctor's order within the patient journal may remain unchanged. Carbon copies of the doctor's order from within the patient journal is removed by an RN or the HUC and transferred to a box on the patient journal cart. The box functions as a mailbox to update the pharmacy about new orders. In practice, the pharmacy discovers if they do not have an updated order when, for example, an RN calls in the morning for a drug from an order submitted the night before, but the pharmacy has not yet received that order.

Charges Medications, syringes, and bandages all represent items that require documentation for reimbursement, whether that reimbursement comes from Medicaid, Medicare, patient insurance, or private funds. As charges are accrued for a given patient, stickers are affixed to the charge sheet (Figure A.10) for that patient. Of course, if the medication cart is wheeled to a given room and a charge is accrued, the RN may affix the sticker to her apron or the cart so that she remembers the charge until she is able to transfer the sticker to the appropriate patient's charge sheet. Charge sheets are filled out in the evening for all patients, and are due by midnight. Unfortunately when the stickers are stuck onto gowns of those administering care, the RN may forget to transfer the sticker if she is very busy or is called into another room before she returns to the nurse work station to update the patient's charge sheet. In the meantime, the sticker may lose its ability to stick and with time fall off the gown. I found stickers in the staff bathroom and on the floor of the nurse work station. Figure 7.7 illustrates the work routines associated with a properly handled charge.

Patient Journals In addition to the individual MARs, each patient has their own current patient journal. Any previous hospital visits are kept in a storage journal and stored in the basement of the main St. Joseph's facility which the nursing home and hospital share. For patients currently in the hospital, both journals will be kept in the nurse work station on the patient journal rack during the duration of the patient's hospital stay. Following the stay, the current journal contents will be added to the older journal and that will be returned to basement storage. The patient journal rack is wheeled and is quite a bit taller than the average nurse; binders lay with their spines facing outwards. This way patient and doctor name and room number are clearly visible on all journals. Additionally, bright orange "Allergic To:" and "Do not Resucitate" stickers may be affixed to the spine. In addition to these stickers intended for quick notification, charge stickers may be affixed inside the journal as a reminder of specific procedures for which costs must be reimbursed by either the patient, their insurance, or one of Medicare or Medicaid. Journals that are being frequently referenced and those which need to be passed on to a doctor or nurse for review, signatures, and care updates, or to the HUC for typing, are put in a pile on the corner of the work station desk. When present, tabs are pulled out of the book to indicate what type of treatment the journal is awaiting. When a journal is intended for more than one employee, the idea is that whoever gets to it first, returns it to the pile after doing whatever they needed to do. Found next to the current journal is a patient's previous journal, in which all previous visits are logged. The present journal makes no reference to previous hospital visits, even in cases where two visits are related. One RN explained that because of the "advantage of such a small hospital", medical staff will often remember a patient and know to reference the old journal. Of course, bedside manner may be enhanced by familiarity and, if a doctor's memory allows her to provide her patients with better bedside manner, that is a definite plus. And of course, if this were not important to patients, people would have no qualms going to a different doctor each time they needed a check-up or something was wrong with them. But, doctor memory is not always sufficient and clear and therefore precise records go a long way toward assuring safe care and reducing errors caused by faulty memory. Figure 7.8 illustrates how and by whom the patient journal is used.

Addressograph Plate Stamper Journal forms as well as the MARs must be labeled with basic patient information in order that there be no record confusion. Given that information flow is not computerized, the nurse work station is equipped with an Addressograph Plate Stamper machine which imprints patient name, address, and social security number onto a plastic card which may then be pressed into any records for that patient. For example, the plastic card is used to make imprints on wrist bands and hand-written forms that are permanently filed in the patient journal. Using the plastic imprint cards from the Addressograph Plate Stamper requires a three-step process (see illustration in Figure 7.9).

Telemetry Machine In addition to recording tools used by the HUC, RNs, and RN support staff, there are tools whose only purpose is to alert staff to a changed or serious situation, and which may create distractions in an already busy room. For example, a screen displays data from five patient telemetry machines. This screen beeps to indicate that one of the displayed patient's data is not what it should be; during my time there, the machine was beeping most of the time, but the majority of the beeps could be ignored because they were due to a condition that the RN was aware of with a specific patient. Such exceptions are apparently common and mean that the machine is frequently beeping when all the problems are accounted for. See Figure 7.10 for an illustration of the work associated with use of the telemetry machine.

Scanning Radio Adding to the ringing telephone, beeping telemetry display, and employee chatter is the scanning radio. This radio is constantly turned on and though I was distracted by it, it did not seem to bother most of the employees nor did they seem to be listening to the radio. I asked what good it did when no one was listening. Apparently a specific tone identifies when an alert originates in Vernon county where St. Joseph's is located. While not actively thinking about the radio, employees explained that they were aware of the radio and ready to act if the tone was heard. If this alert is heard, nurses know to listen and get a "heads up" that a patient is coming into the ER. This means that the room can be prepared for the type of alert and even, in the case where enough detail is

given that a patient name can be determined, a Face-Sheet may be prepared for the patient, and someone can call down to journal storage in the event that the patient has previously been treated at St. Joseph's. The EKG machine does not work without a patient number and this allows the proper patient number to be input and stored with the data rather than the emergency input number 111 where the data must later be copied over to the proper patient number. In other words, if aware of an incoming ER patient and prepared with basic patient information, not only is it possible to collect information relevant to patient safety (for example, allergies), but later work is reduced. Therefore, these type of preparatory activities help reduce ER stress when the ambulance actually arrives as well as after the fact. Figure 7.11 illustrates the work that occurs between when the radio tone indicates an incoming ER patient and the patient's actual arrival.

Hospital Communication Book In addition to all of these obtrusive devices and the regularly used tools such as the MAR book, patient journals, charge sheets, Addressograph Plate Stamper, etc., the nurse work station desk is home to a chaotic collection of Post-its and scattered papers with phone lists, manuals, and information folders such as the "Hospital Communication Book" which all employees are supposed to read daily; Figure 7.12 illustrates use of this book. This book contains hospital calendars, important printed emails and messages, as well as potluck invitations, and entry information for a "Fundraiser Cookbook." It is the official place where "Please Read" notices are posted, and taped inside the back cover of the book is a Post-it that reads "This book will be emptied each month into the 'Master' book on the counter by the sink. Please initial when you have completed reading an item. Thanks!" At the time I flipped through the book, content in the book ranged from 2004 to the present. With the information overload in the nurse work station, it was unsurprising that I never once saw any employee open the Hospital Communication Book. I discovered it buried under a pile of other papers in the corner with the computer.

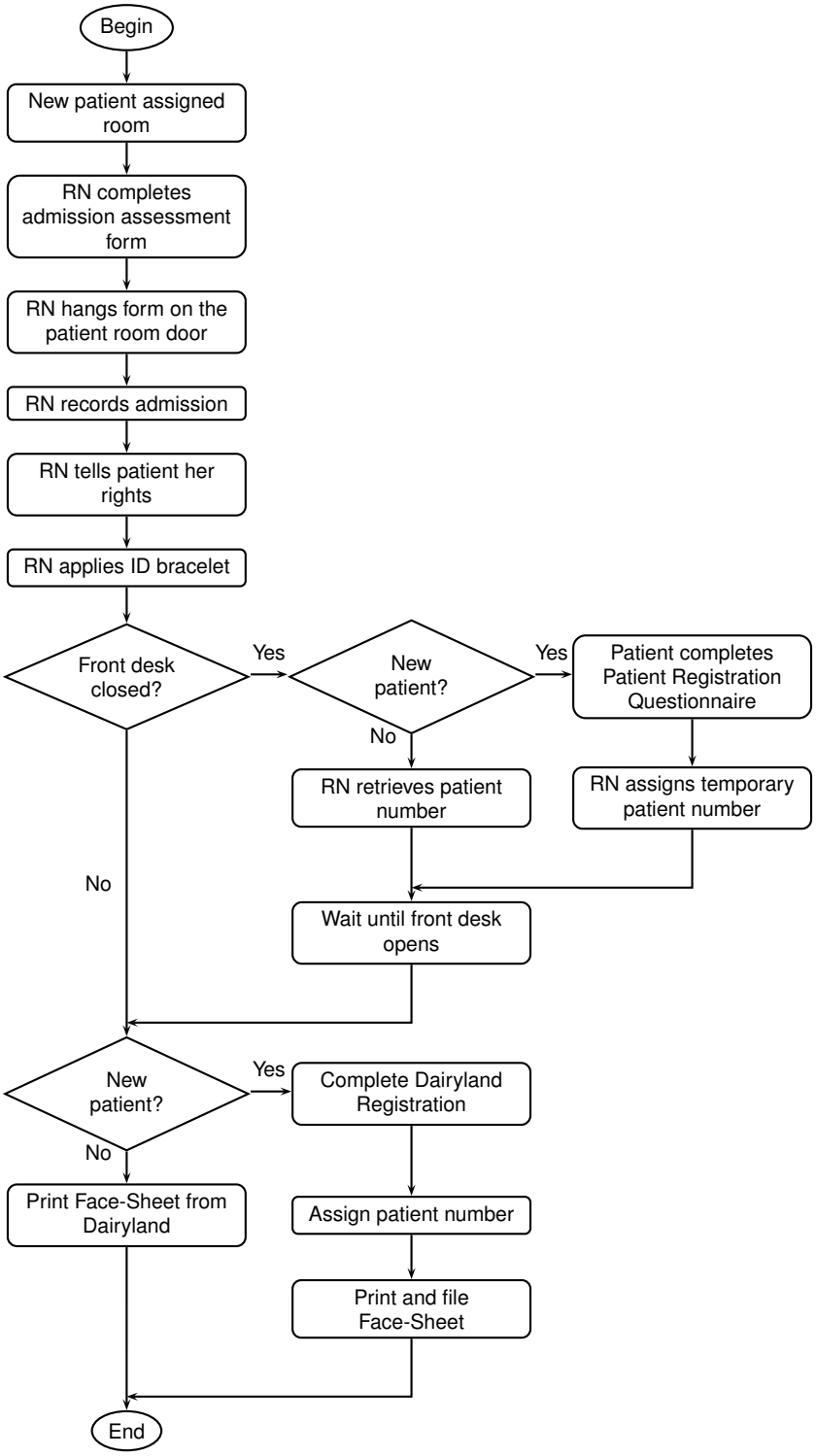


Figure 7.5: Admissions Process

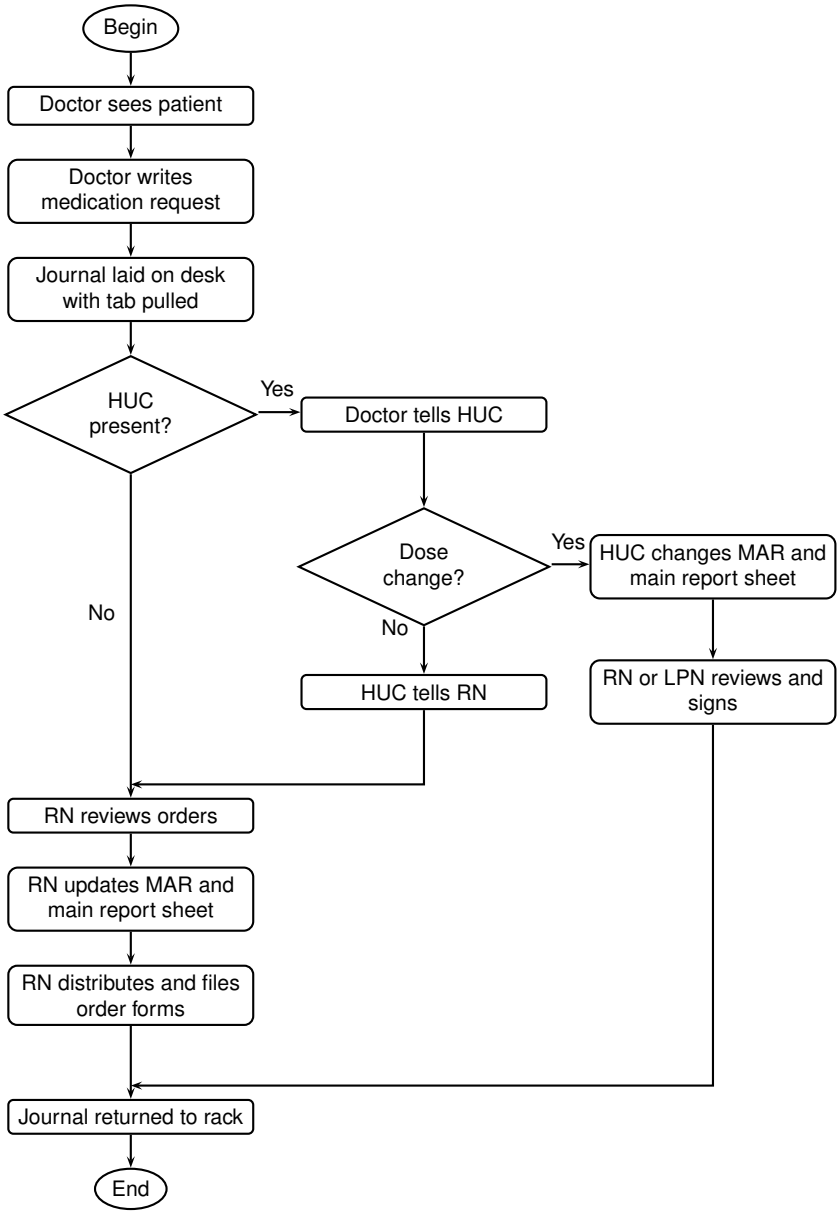


Figure 7.6: Medication Order

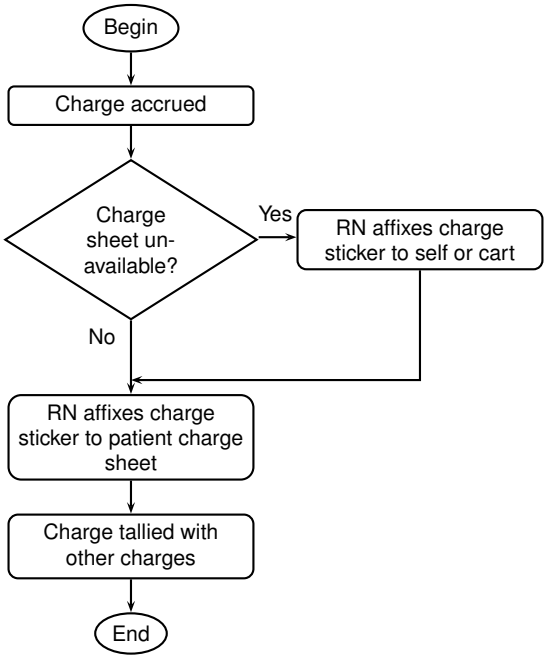


Figure 7.7: Charges Process

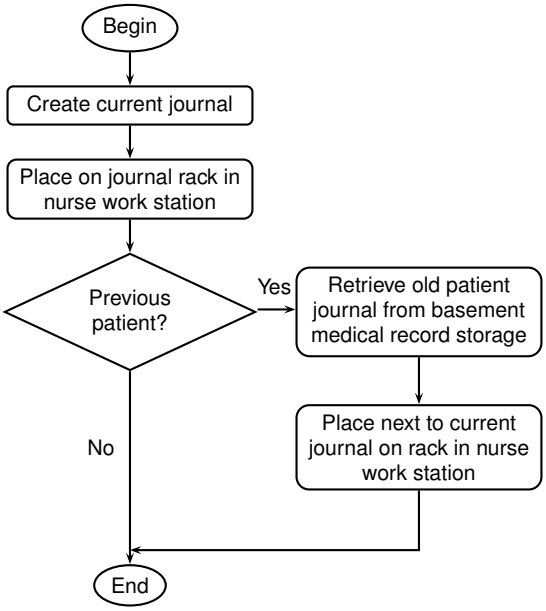


Figure 7.8: Patient Journal Accessibility

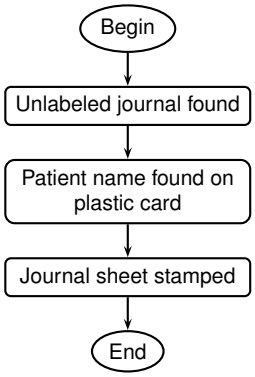


Figure 7.9: Plate Stamper Process

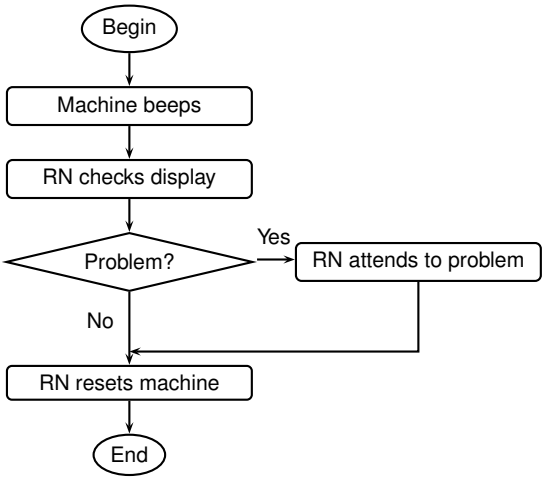


Figure 7.10: Telemetry Machine

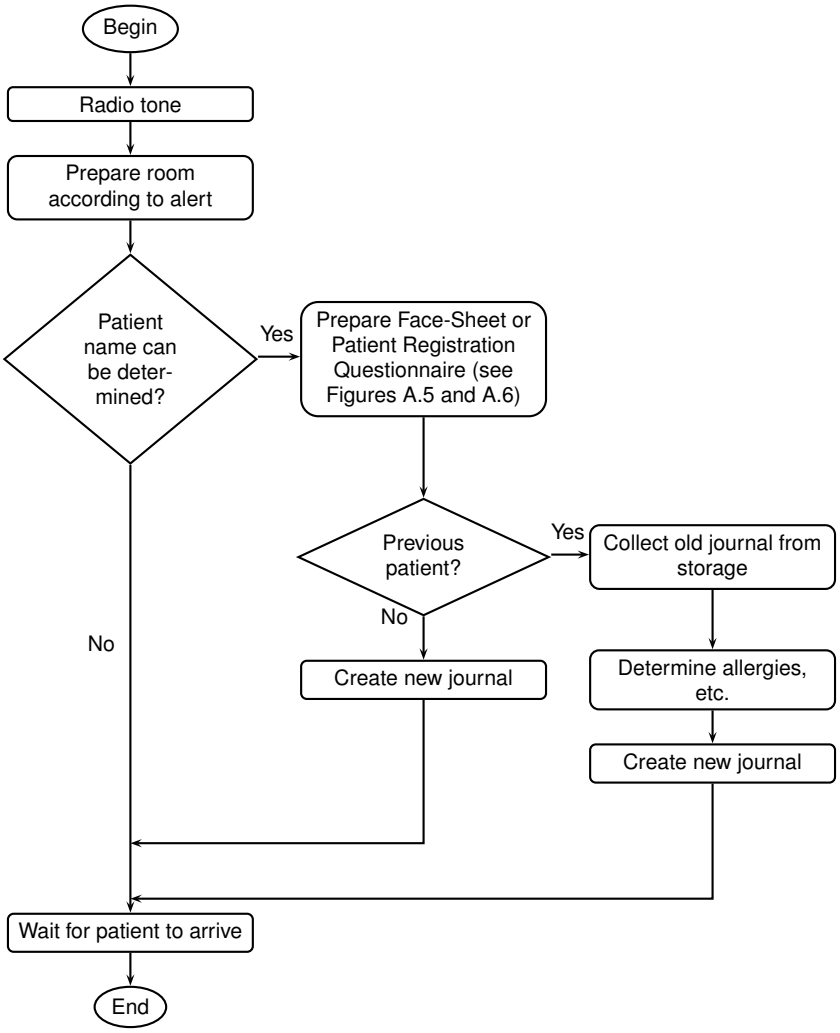


Figure 7.11: Scanning Radio

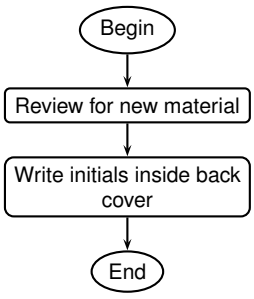


Figure 7.12: Communication Book

Part III

Analysis and Conclusions

Chapter 8

Redundancy and Error

Employees with little or no technical and/or computer skills voiced concern that a new IS would create errors or unexplained data loss. The introduction of IT in healthcare does raise legitimate concern for errors due to the disruption of the traditional communication flows. Throughout a shift, nursing staff may discover that they are missing information or they themselves may have information needed by other staff. And, "... when time is spent trying to find missing information instead of talking to patients, the ability to provide quality care is further impeded" (Elder and Hickner, 2005, p. 618). Efficiently communicating this information requires staff coordination and discretion regarding the use of redundancy. Redundancy may or may not be productive, and whether the value surpasses the effort may be difficult or even impossible to determine. By this argument and for the purpose of this analysis, redundancies may be broadly categorized into a spectrum from productive to unproductive (sometimes even counterproductive) where the middle represents a gray-zone. The productive value of a redundancy may be determined by examining whether the associated inefficiencies outweigh the associated results. Determining the productive value of a redundancy may be approached by asking the following questions: how do the inefficiencies and results balance out, or what price in terms of time and resources is paid for which results? For whom is the redundancy useful and in what context? Even when these questions are examined and carefully argued, some of these cases will remain unclear and hence

fall into the gray-zone. An overview of the criteria and some examples of unproductive, productive, and gray-zone redundancies appear in Table 8.1. Because of my focus on paper routines in both my early interviews and later observation-based interviews, and the enormity of a study focusing on both oral and written communication, an explicit, detailed discussion of oral redundancies is outside the scope of this project. However, given that oral redundancy plays a constant role in communication exchange and the production lattice within the hospital, certain aspects of oral communication and redundancy are considered necessary in the analysis of other redundancies and, as such, oral communication is briefly outlined with consideration for the best placement for certain verbal redundancies along the spectrum of redundancy.

Information may be communicated orally or in writing, and some information is communicated in both forms. For example, a narrative style "nurse notes" entry in the patient journal may mirror the oral narrative given at nurse report. When information is communicated in both forms, a redundancy occurs in the work routines of the person conveying the information and also possibly in the work routines of the person receiving the information. Oral, narrative information exchange may influence the interpretation of the information differently than would written exchange. Coiera and Tombs (1998, p. 675) refer to disruptive, synchronous versus asynchronous communication. In synchronous communication, two people are engaged in face-to-face or telephone conversation and this type of communication is often characterized as disruptive and contributing to inefficiency. In

Type	**Criteria**	**Examples**
Productive redundancy	moderately inefficient decreases error potential reinforces quality	ordering medication RN & doctor reports
Gray-zone	moderately inefficient moderate error potential unreliable result	note-based charting synchronous reports
Unproductive redundancy	inefficient increases error potential undermines quality	admission paperwork copying med. orders duplicating cheat sheets

Table 8.1: Redundancy Spectrum

asynchronous communication, both parties do not need to simultaneously partake in the exchange of information. It is possible for them to exchange information via various messaging systems—email, voicemail, letters. In medicine, events occur which require immediate response, and the initiating party seems to need recognition from the recipient that the message has been received. This need for acknowledgement may lead to appropriate interruptions—synchronous communication—but will also and likely more often lead to situations where asynchronous communication would suffice. St. Joseph's employees have email and voicemail, but neither is used reliably. Some employees are more conscientious than others, but most reported not finding the time to check and not needing to check due to verbal exchanges. In addition to preferences for synchronous communication, email goes unused due to individual computer insecurities and a lack of available computers. Relying so heavily on verbal exchange raises not only the risk that something may be forgotten, but that something may be misunderstood without any context for double checking. In such a small town it is a likely scenario that two patients with the same last name and similar first names might be being treated simultaneously at the hospital; if information is passed verbally and not in written format, there is no opportunity to visually check that information passed verbally from one employee to another does not end up confused with the other patient.

Interruption might lead to distraction and hence errors such as confusing patient names. Clearly the disruptiveness inherent in medical work creates opportunities for error and ought therefore to be avoided when possible. Consider the difference between a system where someone interrupts you to deliver information versus a system where there is no forced disruption and you rather check a given location (sometimes repeatedly) for a needed piece of information. Recall Grudin's (1988) calendar example. Requiring employees to keep their appointment books up to date at all times was an administrative convenience, but a time consuming, added task for employees. The idea was not flawed, but the implementation of it was. Technological enthusiasm and the belief that technology will solve existing problems can mean that technology is self-promoting. Imposing technology on work routines sometimes is given precedence over understanding and respect

for employee and medical needs (Coiera and Tombs, 1998, p. 673). In contrast, technologies that are implemented in such a way that they increase user convenience are more likely to be welcomed. As one confident pool RN explained, in her other job the surgery schedule is computerized which makes her job easier; rather than being assigned work times based on publishing her entire schedule, the surgery schedule was published and the employees worked around that. From a coordination perspective this is also a more logical and efficient approach. This RN explained, "We choose times. It's more efficient than running that piece of paper to all the departments." Time constraints mean that effective coordination, such as that described by this RN, cannot only minimize work efforts associated with redundant activities and unnecessary interruptions, but will likely also lead to a reduction in error.

Whether information is passed along in verbal or written/computerized form (or both), communication and coordination errors represent an opportunity for serious error. In fact, communication errors account for twice as many deaths as errors due to the lack of medical competence or skill (Walsh, 2004, p. 1185). Some argue that redundant behaviors help catch communication errors and as such are essential to quality care. Of course, others argue that redundancy creates opportunity for communication error and misunderstanding. In fact, the most balanced argument claims that while many forms of redundancy are harmful, there are certain types of redundancy that are beneficial due to functioning as a double-check system (Cabitza et al., 2005, p. 160). In these cases, redundancy may involve duplicate efforts by multiple employees who cooperatively reinforce one another's work. At St. Joseph's, the handling of a medication order is a prime example (refer to Figure 7.6). That this paper-based work flow is redundant does not mean that it is inherently flawed nor is it necessarily an improvement if an electronic system removes this redundancy. In fact, in this case, safety is increased because each of the doctor and RN must review and sign the order and finally, before the order is filled, the pharmacist does the same. The price paid is that one piece of information is reviewed by three workers, but the result bought for the price is ensuring safety by reducing medication errors. While this current redundancy does tend to reduce medication errors, it also could be simplified without losing

the benefit of the double-check on something so important.

In contrast to the seemingly valuable, productive (though overly-complicated) redundancy present in the medication ordering process, the redundancies involved in patient admission paperwork create opportunity for error and are therefore unproductive. For example, given that the non-medical information contained on the Face-Sheet and admission assessment are standardized blanks for birthdate, address, etc., it is unnecessarily complicated to require nurses (during the hours in which the front desk is closed) to record this information twice. Additionally, if the Face-Sheet is prepared by the front desk and the admission assessment is prepared by an RN, the patient must also fill-out the same information twice. If the Face-Sheet were transferable, it would reduce the time spent by both the patient and the RN on the admission assessment and make the focus a medical rather than administrative one. Recall that this particular problem is present in the paper-based system and would not have been solved when St. Joseph's moved to a computerized patient record system had the financial IT system remained the same. This inefficiency is one that the nurses griped about and which signaled an early warning not to use non-compatible IT systems within the same facility.

It is not only inefficient that patient registration information must be copied twice, but it presents opportunity for error without introducing extra opportunities to catch an error. This is because demographic and individual information collected from the patient is not information that a nurse can be expected to correct or to recognize as inconsistent from one form to another. A mentally competent patient will be more likely to know their address, age, and other personal information than will the receiving nurse. It can be expected that the patient will fill out his/her information correctly whereas on duplication, the nurse may not catch a transcription error. A missed or altered name on a drug allergy or a pre-existing medical condition might mean that the patient gets improper or dangerous care. A simple name transcription error could mean that Jon Smith receives Joe Smith's medication. Clearly the duplication of Face-Sheet information onto the admission assessment is an example of unproductive redundancy where the redundancy is both inefficient and increases the potential for error. In addition to the extra work of duplicating patient name and other general data from the Face-Sheet onto the

admission assessment, the ER Register is a third location where this information must be copied and therefore another opportunity to make a transcription error.

After recognizing unnecessarily redundant routines such as the duplication of patient information onto the Face-Sheet, admission assessment, and ER Register, it is important to consider removing the unproductive redundancy from the standard work routine. Of course, removing an unproductive redundancy may create an unexpected ripple effect whereby other routines are inadvertently and possibly negatively altered. And when altering tasks, it is particularly important to "find the optimal interaction level between standard and health care worker" (Timmermans and Berg, 2003, p. 81). During my interviews at St. Joseph's, it was most difficult to address impractical and unproductive work practices which had become part of the comfortable routine, and which were therefore protected, defended, and idealized. Inefficient practices which could be blamed on "the system" or on administrative requirements surfaced more quickly than did those created by staff shortcomings, laziness, or "workarounds" (Berg, 1999, p. 385). RNs griping over the Face-Sheet and admission assessment forms is a good example. In contrast, RNs, LPNs, and CNAs were alike in their inclination to withhold or disguise information related to personal shortcomings or work routines. There was a clear desire to protect inefficiencies which had become routine; because of the "empowerment" derived from being solely (individually or as a group) capable of delivering certain work, it is common for workers to protect work practices and to thereby hinder information system research which is focused on work practice and organizational change (Suchman, 1995, p. 56). St. Joseph's employees' most frequently mentioned inefficient work practices were indeed those which resulted from administratively imposed organizational standards; these imposed standards often involve inefficient and unproductive redundant work practices such as multiple copies of paper charts and re-writing similar details in different locations. Admission paperwork is an example of administratively imposed, unproductively redundant work. In contrast, the medication order process is an example of administratively imposed, productively redundant work which has the important utility of reducing error. Recall that this is due to the fact that in these cases the redundancies function as multiple check-points at which an error may be caught by

any member of the cooperative medical team. Inefficiency does not necessarily translate to increased risk for error and the value of productive redundancy may outweigh the negative impact of inefficient work.

While productive redundancy may improve communication in a paper-based setting by requiring check-points, there is still the possibility that duplicating data may result in inconsistencies (Cabitza et al., 2005, p. 164). For example, in the medication order process, the check-points review data from the same source. As a result, there is no risk of inconsistent duplication in the actual ordering process. However, when an RN copies ordered information to the MAR, to a cheat sheet or other form, the risk of inconsistent duplication is present and is an example of unproductive redundancy. Here the price is repetitive work and the result is an increased potential for error. To ensure consistent duplication from the medication order to other forms, it would make sense if after completion of the three-step approval process for the order, the approved data could be electronically transferred to the other forms. An implied solution is therefore to maintain productive redundancy, but in a computer-based system that would ensure consistent duplication. It is important to maintain the productive redundancy in a situation like this rather than to design the computerized system to skip the check-points and merely duplicate needed information. If the check-points are removed and the computer is responsible for administering duplicate information wherever appropriate in the patient journal, the oxymoron is that then—while the redundancy still serves a purpose of making the patient journal easier to read with less reliance on cross-referencing—the redundancy no longer serves the original purpose of improving communication by requiring several check-points. One problem is solved, but a previously nonexistent issue arises as a problem. As the purpose of this project was not to map the current paper-based system to a computerized system, but rather to evaluate the current system for inefficiencies and error potential, the result of computerizing redundancies does not require further discussion here. What does require further discussion is whether those redundancies identified as productive (or "back end") are serving the intended purpose and are free from unwanted duplication inconsistencies. Given that St. Joseph's nursing staff prefer verbal exchange, a redundant processing of the verbal information would certainly serve a

purpose. As Cabitza et al. (2005, p. 160) write, "As a general rule, redundancy serves to *make* actors involved in a communicative process *sure* of what has been communicated."

Memory-based, shift-end charting was one opportunity for error that I would have expected nursing staff to protect because it reflects shortcomings related to their ability to do the job they are expected to do. And in fact, during my interviews I was given the impression that shift-end charting was not ideal and only occurred sometimes. The explanation given involved placing the blame on administrative requirements that lead to overly time-consuming, redundant activities. During my observations it was obvious that most, not some, charting occurred at shift-end. However, it was also clear that this was not due to laziness and was due to that the staff was truly busy. In response to my question about concern that things might get missed in the paper charting as a result of focusing on memory and verbal explanations, I received the following answer: "It works pretty good, but there are sometimes that it doesn't. When it gets extremely busy... When there are too many admissions, there are things that get missed." This RN was neither lazy nor careless and yet she held a very nonchalant view of the importance of a small detail being missed in the paper records. On the other hand, the redundancy involved in note-based, shift-end charting allows she who is charting to review and more effectively phrase observations and relevant comments. This may help ensure understanding and therefore be a productive redundancy. Of course, in the case of numbers being ferried from a note to a final destination, the chance of a duplication error is greater when the information has to travel farther. If a duplication error occurs, the redundancy of copying from a note to the chart is clearly unproductive. The price of note-based, shift-end charting is moderate and the chances of gain or error due to shift-end charting is also moderate, with neither being more likely than the other. Therefore, note-based, shift-end charting falls in the gray-zone on the spectrum of redundancy and the utility of pocket notes or the cheat sheet is uncertain.

Despite the fact that note-based, shift-end charting clearly falls into a gray-zone where it may or may not be productive (and may actively be counterproductive), many of the obviously literate, eager and/or confident, and computer-optimistic

employees informed me that the nurse report/cheat sheet is a job necessity. The explanation has to do with being able to individually maintain oversight and control of a large amount of data which one has little or no time to organize. Because of the need to contain information in one place until it can be copied to multiple other locations, it is easy to understand why most nursing staff are so opposed to giving up the cheat sheet. The cheat sheet not only serves as a memory jog for information that will be charted or discussed during the nurse meeting, but it also helps individuals who are less skilled in written communication avoid embarrassment. One factor that may make the cheat sheet seem less important than is indicated by the role it plays is that the cheat sheet is technically only used to organize the plan of care for a patient and is therefore not part of the official record. Of course, while it is not part of the official record, it may contain information that needs to be officially recorded. The main nurse report/cheat sheet remains active for 24-hours before new copies are made and distributed. The cheat sheets are not a location for copying patient narratives or other lengthy commentary and, as such, could be easily replaced by an electronic device that allowed for basic input. If the nursing staff had bedside charting or even PDA access to input numbers throughout the shift, these cheat sheets would not be necessary, nor would the risk of multiple versions be a problem. When information must be duplicated from multiple individual sheets onto one sheet, the duplication process represents unproductive redundancy. The explanation mirrors that used to explain why copying the medication order to multiple other forms represents unproductive redundancy. And again, a computerized system that could remove the redundancy related to duplication could potentially improve the quality and accuracy of the notes available on the main nurse report/cheat sheet. To support this claim, consider how one of the pool RNs with experience at a hospital that uses a computerized system described the nursing cheat sheets as a problem because of the risk of relying on one that may not have been updated. She explained, “If more than one copy of a specific sheet exists, then it is relatively certain that at least one copy will not be updated when others are.” At the hospital with computerized record keeping she explained, this risk potential was removed because the record was constantly updated with the most recent information that more traditionally would have been jotted on an individual nurse cheat sheet. Of course, temporary cheat sheets would

be acceptable if only used as memory place holders until the thought could be recorded in the patient journal. This is equally true whether the cheat sheet or journal is computerized or paper-based. In other words, the risk of error in this instance is not due to the fact that the information system is not computerized, but rather to an organizational flaw in the routines of the paper system that results in multiple changed copies of the same document. The main cheat sheet that remains at the HUC's desk is in theory a constantly updated version of all the cheat sheets. Even if the practice reflected this, the cheat sheet at the HUC's desk would still be an interim step to copying the updated information to the chart and, as discussed, shift-end charting based on cheat sheet notes represents a gray-zone redundancy where the price is clear, but the result is variable. Copying first to the cheat sheet, then to the patient journal introduces a redundancy which is not only inefficient, but provides an opportunity for error. Charting redundancies where the redundant effort is individual and not cooperative or where the information can only be confirmed and hence checked by the source of the information lead to unproductively redundant, excess work for nursing staff without the error-reducing benefits of multiple check-points.

There is currently an interim step between nurse cheat sheets and the patient journal. This redundant, interim step is the flow sheet, and as one pool CNA's testimony reveals, the redundant behavior required of the flow sheet begs for error. She explained the following process: "I write it down on a scrap of paper, walk to the nurses' station and transcribe it to the flow sheet. Then I put it in the chart. Even just treatments like what type of bath they had, for example. I either inform the nurse or write it down again. Every time you write it down there's a possibility of error. The fewer times it's written and re-written, the better." Inconsistent duplications are a risk of this type of unproductive redundancy. If we assume that the CNA attempts to inform the RN and that one of the two records the information on their cheat sheet, it is likely that via one of these four sources (the CNA, RN, or one of their two cheat sheets), the piece of information will be recalled during nurse report. This makes it a candidate for copying over to the main cheat sheet and from there into either or both of the flow sheet and the patient journal. Figure 8.1 represents the maze this one piece of information must go through—and the

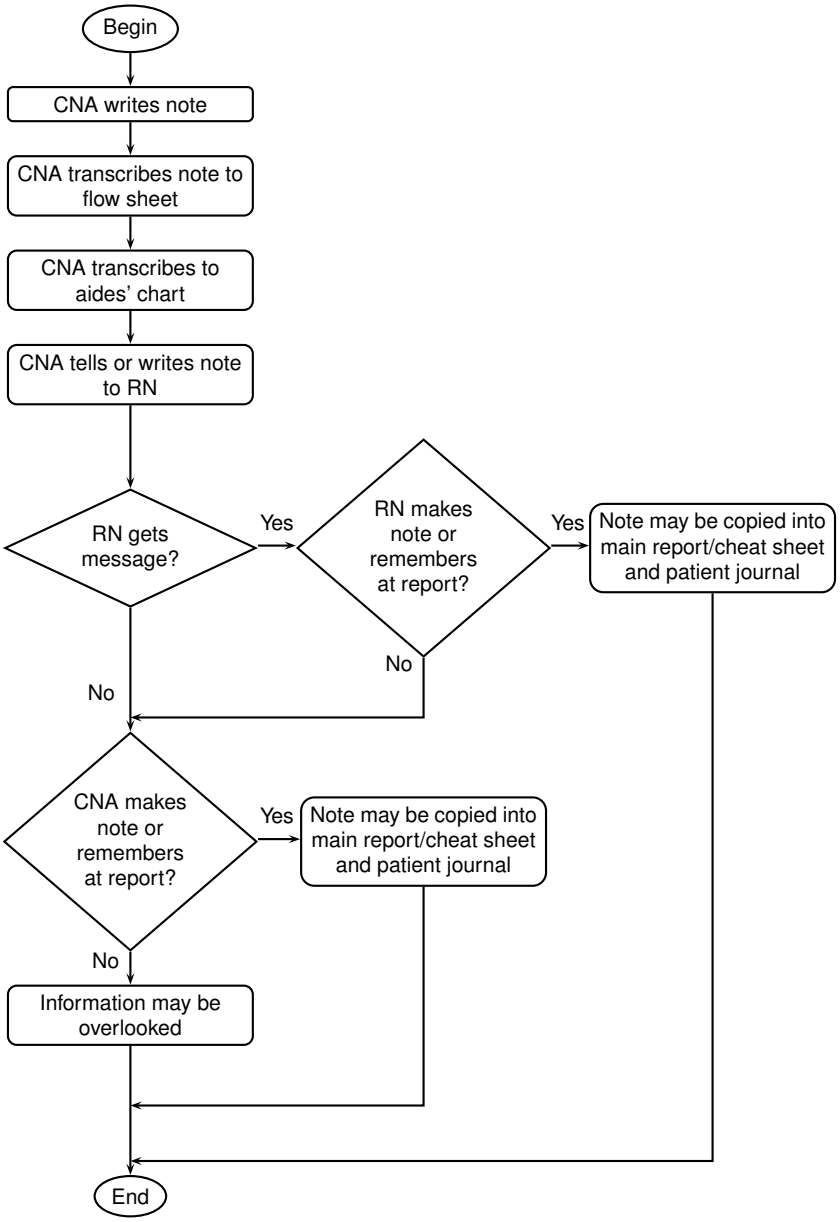


Figure 8.1: Information Flow from Start to Finish

pitfalls it must avoid—in order to get to a final and secure resting place in the patient journal.

As is evident in Figure 8.1, charting redundancies are incorporated into work routines in the present organizational system at St. Joseph's. The same information might be charted in three or more places. At the time of my initial interviews, the

DON and ECS representative were working together to update the paper charting routines prior to computer implementation. Additionally, among many of those interviewed, there was the misconception that a computerized system would largely abolish the inefficiencies of the paper system. This common, but potentially incorrect viewpoint was that change in and of itself indicated improvement. It is important that inefficient work practices be identified and removed, rather than merely reformatted to be doable by computer or any other new twist on the same organizational processes. In my efforts to identify the inefficiencies and potential for error within the paper system, I found it useful to clarify what standard routines exist in principle versus what is done in practice. Such clarity makes it more obvious what inefficiencies exist in the actual work plan. Again, the cheat sheets serve as an excellent example. In principle, the standard routine keeps a constantly updated main cheat sheet at the HUC's desk. During my observations, however, I discovered that in practice, individual standard routines rarely involved updating the main cheat sheet. Therefore, the intended routine is flawed because it requires unproductively redundant work and the actual routines are more difficult to trace for errors because they differ from the intended routine.

The intended purpose associated with two additional hospital systems, the Cardex system and care-plans, are another example of an inconsistency between intended and actual work routines. The Cardex system is intended to provide a quick fact reference sheet for each patient, while care-plans and "critical pathways" (Bemmel and Musen, 1997, p. 335) are intended to function as a pre-determined plan of action that may be altered as new information becomes available. The questions involved in establishing a care-plan include whether or not the patient's medical prognosis can improve, if so how, and if not, how might quality of life be made optimal during its remainder. Care-plans are often not created prior to treatment, but rather long into treatment or even at dismissal. Post-care care-plans have no real purpose, but do fulfill an external administrative requirement. While the Cardex system and care-plans have different intended purposes, they have apparently become largely indistinguishable due to lack of proper application; but interviewees were quick to deflect blame from themselves and toward administrative requirements.

Deflection of blame and the impression that administrative paperwork requirements are inherently flawed leads back into a discussion of the overlap between verbal redundancy and written redundancy and how the former can affect quality or willingness to do the latter. Combating the inclination among St. Joseph's nursing staff to prefer verbal communication and the perhaps erroneous belief that it represents better and safer patient care is a challenge. And while written documentation is important, the case-specific content of verbal communication may often be preferable to overly standardized content. It is possible, however, to physically record information without reducing verbal communication to a series of less meaningful codes and highly standardized phrases. Rather, Walsh (2004, p. 1184) explains that the patient's "narrative" ought to be included in the medical record in an undistorted form. Coiera and Tombs (1998, p. 674) give an example of an inefficient and potentially dangerous oral communication that resulted from reliance on verbal exchange only. They describe a situation in which an important message became hopelessly garbled. The distortion of the message occurred when a senior team member wanted to transfer a patient and sent the message via another employee who then failed to communicate it accurately to the receiving individual. Removing the heavy reliance on memory for shift-end charting provides an important incentive to reduce extra work such as filling in administrative details on the admission assessment form and finding other ways to increase efficiency. This said, it is clear that one of the greatest obstacles to removing memory-based, shift-end charting is the resistance of nursing staff to regular, non-verbal reporting. One of the most evident time-sinks I witnessed was when staff would wait for one another in order to get a question answered about a patient or whether another employee had done a specific task. This waiting and wondering resulted in lost time that could have rather been spent formally recording what they themselves had been doing. Communication that does not require an intermediary party or the presence of both the message giver and receiver offers great potential for reduction of error and inefficiency.

Consider the popular children's game of telephone as a simple and familiar example of the distortions that can occur in verbal exchanges. A group of children sit in a circle and whisper a circulating message to the child on their right. When the

message makes its way around the entire circle and returns to the initial child, the message is often badly distorted and even sometimes nonsensical. The noisier the environment in which the game is played and the higher the level of distractions, the more distorted the message. As has been asserted by the American Hospital Association concerning IT, distractions and interruptions often result in human error. Now consider that at St. Joseph's, nurse report is typically held in the noisy and public nurse work station. And, given one RN's estimate that 85% of what she knows about her patients is received verbally, the likelihood of error due to distortion is obvious. The emphasis on verbal exchange with colleagues is presented in a hospital communication study by Coiera and Tombs (1998, p. 675) where they found that "50% of information came from colleagues, 26% from personal notes, and 12% from laboratory data." Assuming that messages given are in no way distorted due to distractions, consider whether the messages given are accurate in their initial form. For example, during one nurse report, I noted that which was said about a specific patient. I then observed the Grand Rounds meeting and observed that the information reported verbally about that specific patient changed slightly with respect to the time that the last medical problem occurred during the previous shift. An exact transcript of the change cannot be provided because patient privacy regulations prevented me from taking notes during Grand Rounds. Though conveyed verbally and only somewhat distorted, the information provided at the nurse report was not a precise duplicate. The redundancy of repeating the information had a clear purpose given that the doctors had not been present at the nurse report. This is an example where verbal redundancy actually mirrors appropriate charting redundancies because in both cases, duplicate information is desirable for making sure that the recipient has a full picture without needing to retrieve information stored elsewhere.

In the preceding example, the RN verbally duplicated written information in order to present the doctors with a quick overview of their patients. The combination of written and verbal delivery of the same piece of information meant that the information reached more of the medical staff than would likely have occurred if the information was only available in written form. Because of this clear value and the limited work effort associated with the redundancy of also delivering the infor-

mation verbally, this simplified view of the interaction between verbal and written work argues for its placement at the productive end of the redundancy spectrum. The price is low and the value is high. The risk of inconsistent duplication is present, but the consequences are less than if the false duplicate were to be permanently recorded in the chart. In a case where information should be duplicated within the chart, erroneous duplication is problematic because it may be difficult if not impossible to determine which version is the original and presumably correct one. In contrast, when information is first written, then duplicated in verbal form, later questions will be referred back to the original written copy. As a result, any inconsistencies in the verbal duplication will most likely be short lived. Indeed, the doctors' patient knowledge benefited from the RN's productively redundant verbal report of that already documented in written form. Moreover, patient journals are available during Grand Rounds and, though few doctors took advantage of the opportunity to cross-reference the verbal and written information, the opportunity was present. Doctor report and nurse report have similarly productive value related to conveying information in written form and redundantly in verbal form.

In contrast to the productive value of some forms of redundantly verbalizing written information, if medical staff find themselves solely relying on discussion rather than written documentation of patient information, then the opportunity for inconsistent duplication may present more of a problem than the value of the verbal duplication. In addition to a preference among nursing staff for synchronous communication, the challenge of convincing nursing staff that verbal communication is error-prone and does not provide sufficient documentation nor sufficient productive redundancy is a particularly strong challenge in a small town. In fact, you may recall that nursing staff attribute the ease of information flow to St. Joseph's being such a small facility where everyone is in regular contact with everyone else. As one RN put it, "We're not a team if we're not talking" and as another explained, "Smaller things are more passed on in a verbal report. The charting isn't read as much or as important as what we do verbally." Yet, if the redundant messages in a verbal report changes even slightly from one shift change to the next over a 24-hour period, the risk of a distorted message is very

real. Additionally, there is no "back-up" of verbal communication. The majority of the RNs, LPNs, and CNAs do not support formal documentation of shift-to-shift and inter-shift communication. When asked why verbal exchange is preferable, these employees explained that it allows for more human interaction and discussion, and that their pocket notes are too simplistic ("only memory jogs"), even "embarrassing" due to incorrect spelling and other errors. In the opinion of many, transcribing these memory jogs into a note for another employee makes the note seem more important than is deemed necessary; despite this unwillingness to write out personal notes because of risk of making them seem too important, the interviewees maintain that even if inconsequential for the charts, personal notes ought to be communicated to the next shift. In other words, the communication is judged to be important, but not so important that it is worth writing a note instead of passing it on verbally. This seems inconsistent and a weak reason for choosing to convey the message verbally rather than in writing. Staff who have weak non-verbal communication skills may resist logging details and prefer oral communication because they feel more confident in their ability to speak and feel more comfortable exchanging information orally. When information ought to be recorded, such employees may instead choose to pass it along verbally to another employee which reinforces the tendency and preference within the group for verbal rather than written communication. Whatever the reason for choosing to convey messages verbally rather than in writing, the result of preferring verbal exchange means that some staff are inclined to make memory jogs without any formal charting until the end of their shift. Most individuals indicated that this results in lost details. The loss of small details across individual cheat sheets may compound into greater losses in the overall communication about a given patient.

The most common thread across the redundancy spectrum is that of whether or not the redundant work requires redundant thinking or speaking, or whether the redundant work involves redundant writing. Both redundant thinking and speaking seem most often to increase the likelihood that an error of faulty opinion is caught. For example, discussions at nurse report and Grand Rounds provide an opportunity to rethink and discuss patient results and needs. Even note-based, shift-end charting may have an element of protecting against errors built into

the redundancy—rephrasing from one's own shorthand requires actively thinking about the information. To recap, rethinking notes and orally communicating written work are both examples of potentially productive redundancies. In contrast, written duplication of already written information provides an opportunity for inconsistent duplication. Therefore, written duplication of already written information represents a clearly unproductive or even counterproductive type of redundancy. It will be crucial that St. Joseph's administration attempt to alter unproductive redundancies and retrain staff to the importance of those changes before it will be possible to move to a new computer-based system. Chapter 9 offers an overview of how changes might be made to the current system, as well as how a new system might most effectively be introduced.

Chapter 9

Changing Work Routines

In Chapter 8 work routines at St. Joseph's were analyzed to identify redundancies and to determine the value of the redundancies found. Some of the redundancies were deemed productive and in as much, important to keep in any reorganization. Other redundancies were deemed gray-zone redundancies and varied from relatively useful to relatively useless. Finally there were unproductive redundancies which in theory ought to be removed during the process of reorganization of the work routines and information systems at St. Joseph's. Unfortunately, while the choices of which routines to keep and which to disgard may seem obvious if based solely on the discussion in Chapter 8, the decision to remove a redundancy is in fact more complicated. Various tasks make up work routines and between starting and finishing a given work routine, individual tasks involved in its completion may overlap or interact with tasks associated with a different work routine. Together the many task chains at St. Joseph's make up the "production lattice" (Gasser, 1986, p. 210). As a result of the interactions or overlap that may occur between task chains, changing a work routine rarely affects only that work routine. This means that it is important to provide a greater understanding of the potential for unintended consequences. To provide this understanding, it is useful to look more closely at a couple of the examples discussed in Chapter 8.

The task chains in Chapter 7.3.1 represent intended work routines at St. Joseph's. The task represented in Figure 8.1 involves the transcription of one piece of in-

formation to multiple locations; in this figure the intended routines are shown together with the many uncertainties that develop between the start and finish of the task chain. Gasser (1986, p. 210) writes, "*In any particular instance, the precise structure of the task chain is unpredictable, because it depends upon the contingencies of the work process, including intersecting task chains*." In contrast, if this task chain were standardized via a computerized system, perhaps the productive redundancy associated with re-thinking and reformulating the note contents would be maintained, while the unproductive redundancy of creating multiple duplications of the reformulated information would be unnecessary due to computerized duplication. If such a computer-based standardization were to occur, the task chains should look much the same from one occurrence of the task to the next. Secondly, standardized tasks ought to maintain the productive redundancy revealed in the medication order process, but minus the instances where independent workers actually re-do one another's work. In other words, where human error risk is a high concern, it makes sense to standardize cooperative review of information. Finally, if the production lattice is restructured and unproductive or unnecessarily overlapping (inefficient) work tasks are removed, actors may or may not adjust to these new and more efficient standardized routines. Moreover, altering tasks inevitably alters more than that which is intended.

9.1 Standardizing Routines

The redundancy spectrum (productive, gray-zone, unproductive) described in Chapter 8 provided criteria and case study specific examples of each of the three categories along the spectrum (Table 8.1). In theory all unproductive redundancies ought to be altered in order to make the hospital more productive; the examples of unproductive redundancy that were explicitly provided in Chapter 8 are admission paperwork, the medication ordering process, and the duplication of cheat sheets. Despite the fact that these unproductive redundancies ought to be altered in theory, changing work routines is risky because one alteration may cause unforeseen or unwanted effects to other work routines; Ash et al. (2004, p. 105) write, "We frequently observed instances in which the intended strengthening of one link in

the chain of care actually leads unwittingly to a deletion or weakening of others." Therefore, it is worthwhile to establish a change spectrum that identifies the difficulty associated with implementing a given change, as well as the value of the result, and any likely impact that change may have on other work routines. Impact on other work routines can range from minimal to high impact. It tends to be that the easier the change, the lesser the results and impacts on other routines; it is once again useful to think in terms of whether the price paid (in terms of work efforts necessary to change old routines) is balanced by the results achieved. While my research indicates that easier changes will tend to have lesser results, Berg (1999, p. 394) explains that, "The more powerful the coordinating activities of the artifact, the more the work of medical personnel *has to change to be changed*." Table 9.1 shows the change spectrum categories by difficulty level, results, and potential impact on other work routines in the production lattice. Examples of routines that correspond to the different difficulty categories are noted as well.

The original timeline (Figure 7.1) for ECS introduction was based on an evolutionary approach. First, the admissions assessment form was to be electronically implemented. Following this, other elements of the admissions process were to be electronically implemented. When this timeline was established, it was presumed that it would be possible to interconnect the existing Dairyland softare with American Data's ECS. Recall that hospital administration and the ECS liaison both cite interconnection problems as one of the reasons ECS development was postponed. While fixing communication between Dairyland and ECS would have eliminated

Difficulty Level	**Expected Results**	**Routines to be Changed**
Easy	small change minimal impact	phone services
Challenging	variable change variable impact	admission paperwork
Difficult	significant change high impact	ordering medications duplicating cheat sheets

Table 9.1: Change Difficulty Spectrum

the redundancy of duplicating information already on the Face-Sheet, in general, problems in the current system must be sorted out before there is any point in choosing a new system. If the same poorly patterned work flaws are introduced into a new system, they may become standards in that system as well and the new system may be no more efficient than the previous one. This is one reason why it made sense that interconnection problems between Dairyland and ECS were regarded as a true barrier to progress rather than as a situation that could be worked-around. Be reminded of Bemmel and Musen's (1997, p. 331) comment that "Computers are a means to an end and not an end in themselves." When the task chains are sorted out, standardized, and generally made more effective and safe, then is the appropriate time to introduce an entirely new information system into the hospital. In the case of St. Joseph's, when the time is appropriate, that new information system will be a computerized one with the hopes that the paper one will become obsolete.

Many members of the nursing staff independently informed me that their awareness of redundancy and the value of greater standardization increased when administration began to push for a new and computerized information system. Even the most change-resistant staff indicated that they would prefer using a computerized system if it could simplify the admissions process or any number of other work routines such that each piece of patient data could be input one time rather than recurring times. Many staff indicated that they are less careful and more prone to leave out details when they tell or record a piece of information for the second and third times. As discussed, routines incorporated into a computerized IS could be standardized in such a way that human-made duplications were no longer necessary. Even when employees understood that a computerized IS offered such benefits, the fear of using a computer system for admission paperwork was still lower than for using it in clinical paperwork. There seem to be two primary reasons for this. The first reason is the fact that all nursing staff are used to printing some information from Dairyland when the front desk is closed. Therefore, a part of the admissions process is already computerized which likely makes it less intimidating to computerize yet more of the admissions process. The second reason is that a mistake made in the clinical paperwork is more likely to have a serious

consequence than is a mistake made in administrative or admissions paperwork. This means that there is a higher resistance to using an unknown system to complete clinical work than for using an unknown system to complete administrative work.

Easy Change Installing a computerized switchboard menu on the telephones at St. Joseph's is one example of an easy change that would have a minimal impact on work routines not related to nurse report. The cost or efforts required to make the change would be technical and human. The technical cost would include building a menu into the phone system while the human cost would be the required learning curve of staff calling within the hospital or others calling into the hospital. Encountering a computerized menu is common and requires very little of the human component. The value returned includes decreasing stress and noise at nurse report and in general at the nurse work station. Additionally, a side benefit might be that any exposure to positive technology-based improvements might have the benefit of reducing overall anxiety about other hi-tech behaviors. Compared to the expected value return, it seems that this change is relatively easy and not too costly to implement.

Challenging Change The unproductive redundancies of the admissions process occur in isolation from other paperwork that occurs throughout the patient stay. For this reason, it seems logical to electronically implement the sequence of work routines for the admissions process in one stage and to do so prior to implementing any other sequences of work routines. The implementation of a revised admissions process might be done in a single stage together with all other changes to the work routines so that everything was functional from the first day; or one work routine after another could be implemented until all those associated with the admissions process were in place. The first approach can be referred to as implementing the change dramatically while the second approach refers to a more evolutionary approach to change. In the case of the admissions paperwork it seems that the dramatic change approach is preferable to the evolutionary change approach. There are several reasons for this opinion. For starters, even though

the front desk uses Dairyland, if ECS and Dairyland were able to properly interconnect with one another, then only the RNs would need to be involved in the admissions process. This would mean that only the seventeen RNs would need to be trained, rather than having to train them as well as having to train the front desk staff how to import or provide Dairyland information to the RNs. Another reason that it would be preferable to change the admissions process all at once is that the very reason for changing the routines associated with the admissions process is that they require duplication. If only the admissions assessment form were to be electronically implemented while the rest of the admissions paperwork remained paper-based, the RNs would actually have an increased work load. They would have to log into a computer to complete the admissions assessment and then copy from the screen or a print-out to the other forms. The routines would be exactly the same as previous to electronic implementation of the assessment form except that now the admitting RN would require two tools (computer and paper) for an admission rather than just one. Even though this period would be short-lived, it would temporarily increase the time spent on the admissions paperwork. In contrast, if the entire process were computerized at one time, the work routines would be changed in the process because the computer would take care of duplications; and as a result, the element of unproductive redundancy would no longer be present. Another reason that it makes sense to start with the admissions process separate from other areas of work that will eventually need to be revised is that the RNs have authority and leadership over the rest of the nursing staff. It seems that there would be a social incentive for the other employees to follow the initiative of the RNs. Furthermore, because the RNs are responsible for the admissions process and they only constitute about half of the total nursing staff, the price in terms of time and effort to make the change would be limited to the need to train half the staff; yet the results would involve speeding the process for all new patients. Finally, because the admissions process occurs in isolation, once it is completed, this set of routines should not require revisiting in order to change other work routines. Therefore, if change is made dramatically rather than routine by routine, the changed admissions process will have a relatively minor impact on other work routines. In contrast, if changes to the admissions paperwork occur one by one, each change will result in changes to the remaining paper-based ad-

missions routines. As a result, a slow or evolutionary change process is likely to have higher associated costs than if the whole process is changed dramatically.

Difficult Change In contrast to the efforts to change the admissions process, changing the process for ordering medication seems likely to be far more difficult, though it is also more important and a successful change would be more rewarding; the price in terms of time and effort to make the change is higher than for changing the admissions process and it also potentially involves changing routines for most of the staff since everyone from the physician to an RN or LPN and the HUC might be involved in the task chain. Moreover, medication orders are neither isolated in time nor do they follow one standard set of routines. Rather, the routines for prescribing medicine may change or involve different actors depending on the time of day, who is present, and whether the order represents an entirely new order or a change in a previous one (refer to Figure 7.6). While the admissions paperwork involves a standard and isolated set of routines from one admission to the next, medication order paperwork is not isolated; whereas the routines involved in the admissions paperwork only interacted with other routines in the production lattice at the start and finish of the admissions paperwork task chain, many of the tasks in the medication order task chain interact with routines related to other tasks in the production lattice. Clearly the cost and difficulty associated with changing the processes for ordering medications is greater than the cost of changing admissions paperwork. The higher cost does, however, seem correlated to a higher value return. The admissions paperwork is unproductively redundant and could certainly benefit from using information technology to simplify the work routines, but despite the clear benefit, errors related to unproductive redundancy in the admissions paperwork are less likely to be clinically relevant and therefore are lower risk. In contrast, errors related to medical orders paperwork are potentially far more serious. It seems that medical orders paperwork would benefit from being more isolated both in time and by group of involved employees. For example, it seems that it would be beneficial if the medicine order paperwork process could be divided into the doctor's order (whether new or a changed order) and nurse signature. If the doctor's order were electronically

input, when the nurse reviewed the order, the order could then be automatically updated in the patient journal, on the MAR, and on the pharmacy order.

The duplication of cheat sheets is another example of a work routine that will be difficult to change. Removing the unproductive redundancy of human duplication of cheat sheets is likely to have a high impact on other tasks because it ought to ensure that new information is quickly and directly relayed to other cheat sheets and that information from one sheet to another is consistent. The likely net effect is a quality improvement in patient care. While the benefits of having exact rather than inconsistent duplications are clear, the cost or efforts required to remove human duplication of cheat sheets are heavy for both the human and technical components of the information system. Financial resources are limited and yet one of the only ways to keep the threshold low enough that nursing staff would be willing to make the switch to electronic cheat sheets would be if accessibility to an electronic tool were equal to that of a pen and paper. Also, being able to record information in a familiar way (for example, by hand writing onto the screen of a PDA) would likely be a great incentive for nursing staff to adopt the new technology. In addition to accessibility, even if the new technology is similarly sized and kept in the pocket like the old technology, staff resistance is likely to be high. The reasons to expect high staff resistance are discussed in Chapters 7.3.1 and 8; these reasons include fears about information loss and inadequate computer skills, as well as feelings of insecurity about the quality of the notes and an objection to saving the notes for others to see and potentially judge.

Gaining the cooperation of nursing staff to change the inefficiencies and unproductive routines in the production lattice may be aided by practicing the principles of socio-technical and participatory design. The socio-technical view (Akrich, 1992) that only some work should be delegated to the machine and some to the human actors might be compared to delegation of work to the written records of the information system as opposed to the verbal flow of information that is preferred by nurses. In the same way that the spouse of an avid computer-user might eventually recognize that a word-processing program is better for long documents than a pen and pencil, so too nurses might eventually adopt the new technology or altered information system for their nursing communication if it is seen to be a

clear improvement over the old system. The problem now for St. Joseph's nurses is that there is no clear benefit to be gained by adopting a new system, even if error statistics do reveal that the existing system is more error prone than alternative options.

Scandinavian healthcare operates on the principles of participatory design or industrial democracy. Rather than convincing the user of the attributes of the new system, the user is herself involved in designing the new system. The opportunity to provide personal input and a feeling of ownership over the final product aid the user in accepting what becomes the new standard. Rather than the product-oriented view, this user-centered emphasis addresses the issues that are most likely to "accommodate learning and communication" (Ehn, 1993, p. 61). Indeed, at St. Joseph's the best source of information about what changes, tools, and training could best help nursing staff adapt their routines came from the nursing staff themselves. Including them in the decision making and change process was an advantage for both them and administration. Ethnographically collected data about job routines and hospital task chains at St. Joseph's provided employee insights into current employee problems and unproductively redundant work routines or data loss due to forgotten notes or non-documented verbal reporting. In keeping with participatory design, this ethnographic study should involve the future users in the design of the future system, while simultaneously using the benefits of medical error research to introduce more thorough documentation. In the case of St. Joseph's, it seems that more thorough documentation may be achieved without increasing workload, but rather by changing work routines to eliminate the unproductive redundancies. Participatory design of a new information system ought to aid in achieving this goal of increasing beneficial documentation while not increasing employee workload. Throughout this discussion, the quality of the technology available and the ways in which it would be taken into use has played a significant role in the assumptions about the difficulty associated with changing work and standardizing routines. Chapter 9.2 describes the attributes desired in a computerized system as well as the training needs identified by current St. Joseph's nurses to be used by them and others in the future.

9.2 Computerized IS Development and Training

As with altering unproductively redundant or error-causing work routines, decisions about staff training will have results that influence not only the training sessions and quality of education, but also whether employees readily accept or actively resist technical aspects of the new system. Even when employees objectively recognize that they will benefit from changing a specific work routine, a lack of proper training may mean that they do not adopt the recommended behaviors by which that work routine is changed. For example, being required to electronically record information might be more intimidating than the perception of benefit from the change might be encouraging.

As of early summer 2006, St. Joseph's remains undecided about whether they will continue forward with the ECS product from American Data. Despite this fact, ECS remains the product for which the training and system development suggestions were made during my interviews. While both concerns and suggestions surfaced regarding ECS or introduction of any other computerized IS, suggestions specific to the employee-program interface were more difficult to attain because, of course, the majority of employees had no visual concept of the system. Despite administrative distribution of information via multiple communication channels, many staff members were unaware that ECS (or another computerized IS) would be introduced. Some of these members were of the opinion that they, as the users, should have had a more clear opportunity to share their thoughts and suggestions prior to the administrative decision to make so drastic a change. While staff that actively participated in the ECS viewing may have self-selected at the staff meeting, other potentially valuable sources of input did not. Regardless of their reason for opting out, their input and participation may be crucial to successful implementation. Also, even if the employees are themselves at fault for not having been better informed, it is necessary to ensure that this inconsistent pattern of knowledge and participation is remedied.

An early and important step would be for administration to formulate a few specific and minimally controversial reasons that change is needed, as well as to explain what it means to be a beta-site, addressing the positive aspects (tailored sys-

tem), as well as the negative (potentially long wait time, interim inconveniences, etc.). About a quarter of the nursing staff told me that "computers are the way of the future" and that that alone necessitates change from a paper-based IS to a computerized one. When the going gets tough, this early willingness to cooperate and go with the flow will be compromised by the fact that the users do not have a solid reason to support this "way of the future." So, in addition to formulating specific reasons for needed change, it is worthwhile to give specific examples of successes that followed the introduction of such systems. Recall, for example, that the nursing home at St. Joseph's had a reduction from dozens to zero citations following the introduction of ECS. Of course, of most relevance to an intimidated employee is understanding how this improvement and reduction of error will directly affect and aid them, and how they can achieve a system wherein positive benefits outweigh the early frustrations.

One important strategy would be to not allow stragglers. To avoid this, workers might be lumped into groups in which members are familiar with one another during training of non-job specific tasks. For example, RNs and LPNs work closely, so to better utilize this easier exchange of information and sympathetic understanding that familiarity engenders, LPNs could be included in the pre-training stages of what will lead into the solely RN training for implementation of the "clinical" or "assessment tool." The same holds for CNAs. Indeed, an often voiced opinion was that, "We believe our own." If ECS is chosen, it might be wise for administration to utilize this by emphasizing Carmen Zirbel's nursing credentials, as well as having someone from St. Joseph's nursing home or from another hospital talk about the process of converting from paper to computer charts. However, because of mixed views about ECS in the nursing home, as well as fears about how ECS may be altered and made applicable to a hospital setting, it might be better to have someone consult from a different hospital. Among the pre-training options, there could be a course titled "Introduction to using a computer" in which basic computer skills are introduced. For example, a basic course could cover skills such as turning on the computer, mouse/spatial skills, logging into the computer, and logging into a mock ECS (or some other specified program). A typing course is another pre-training measure that had tremendous support and is definitely needed.

To collect training suggestions, I opted to encourage imagination, rather than to play by the rules of reality imposed by restricted resources (time, money, and number of staff). By encouraging freedom to suggest outside of what was "realistic" or "practical," I collected a number of ideas that might be feasible under the limitations that actually do exist. Suggestions deemed necessary included small group training as opposed to en mass training, with weight on supervised opportunity to practice. For this reason, training ought to occur in a computer equipped room, with only one student per machine. The hospital plans to use its "library" room which was established via one part of a $60,000 grant from the National Library of Medicare, and which provides the hospital with an audio-visual classroom/library, useful for both in-house training and for distance learning (St. Joseph's Community Health Services, 2006). In addition to having small groups, many staff favored self-placement in ability-based groups. While there were some that preferred mixed-ability groups, they were okay with ability-based groups, whereas those preferring ability-based groups were not okay with mixed groups. In brainstorming with interviewees about how they could know what group suited them for self-placement, interviewees preferred self-selection based on a breakdown of where each group will start and what one's user skills ought to be to take part in that group. The most timid users were concerned that they would be permitted too little time to master the skills during the course, while the most advanced users were concerned that without ability-based groups, they might have to devote more time than was required to the learning process. A balanced perspective was that in non-ability-based groups the advanced users could help the less advanced. But, while this plays to the idea of inter-group trust and diminished discomfort when supported by co-workers, there were barriers to this approach. During the pre-training period, the added cost of financing multiple slow-paced groups is one clear barrier, since the agreement with ECS does not include training for basic computer and keyboarding skills. A less frequently mentioned barrier was expressed by the few for whom hierarchical confrontations posed a clear social problem on the job; keeping in mind that computer talent was very correlated to age, for these employees with job-related social hierarchy issues, there was a threat involved in acknowledging a professional weakness that could be taught to them by their professional hierarchical inferiors. However, de-

spite a general preference for ability-based groups, there was almost unanimous support for pre-training a select group that would be available for one-on-one support on the floor during the first week of implementation. The emphasis here was on the "familiar face" and the familiarity of the trainers with the environment and staff. The difficulty with achieving this is that St. Joseph's is a small hospital and this would require that the pre-training group not be on hospital-duty, but only on tech-support duty for that week. The suggestion that there be a tech-support trained group to help others during their regular shifts was politely dismissed due to a feeling of pressing inability to complete those tasks which already are required during one's shift. Training specific suggestions are summarized in Table 9.2.

These suggestions are based on user familiarity (and in some cases, dissatisfaction) with either St. Joseph's nursing home ECS software and/or charting software at another facility; recall that at the time that these interviews were conducted, I had not yet seen the ECS software. Carmen Zirbel shared my opinion that conducting the interviews prior to seeing the software was advantageous because I would be more inclined to keep an open mind. That said, after compiling initial suggestions, one of my interviewees demonstrated for me the Nursing Home's ECS software. Following that demonstration, the suggestions I had received fell into context as did my own reservations, as well as recommendations for potential methods to strengthen the system. Even so, the demonstration to which I was privy was short and, because of HIPAA rules, I was unable to do the self-clicking that I would have needed to have a more intuitive experience with the software. Therefore, some of the suggestions I received were general concerns voiced by employees about software problems they have encountered elsewhere. For exam-

Training Suggestions
basic computer skills course
typing course
training in small groups
ability-based groups
group self-selection

Table 9.2: Training Suggestions

ple, some expressed concern about screen readability and program consistency. For screen readability, one user complained that while vertical scrolling is fine when it is necessary, horizontal scrolling or a combination of the two makes it difficult to comfortably read charts. Consistency was a more prevalent concern; users repeatedly gave the example of 24-hour time being less prone to error than 12-hour time, and therefore requested that the program only permit 24-hour time entries. One commonly mentioned concern was that related to the differences between a nursing home and acute care. Indeed, many adaptations would be required to move ECS from the long term healthcare setting of a nursing home to the short term, high turnover of a CAH. For example, while the nursing home has a list of all patients, such a list will likely not be sufficient in the hospital due to the high turnover rate. Ideally, American Data would respond to different user preferences and learning tendencies by organizing access to individual patient charts by either a list of patient names, or a list of room numbers. The two could be cross-referenced.

Other system specific suggestions included limiting the number of ECS screen buttons to those that are necessary at all times, as well as providing more information about what the buttons do, and more descriptive names of options in the drop-down lists. Additional information can be provided in non-cluttering ways, such as making the buttons larger, with writing on them, and with mouse rollover for a longer explanation. The buttons ought to be designed according to educational principles, as it is indeed the responsibility of the designer to impart use to the user. In fact, what I found in the users that were familiar with ECS was that these users do the exact same processes over and over, but find that they are confused and unable to proceed when there is something even remotely new. In short, the program seems unintuitive.

Some additional system specific suggestions included making ECS appear more like the leading tabular system that is used by hospitals across the United States. While ECS does use a tab system, the orientation and color of the tabs is different than in the paper charts used across the US, which if the program is first going to resemble/draw on traditional organizational techniques, it ought to do so more overtly, and thereby take advantage of the already established comfort with the

organizational layout. For example, rather than the unintuitive use of MS-DOS and other non-HCI focused software that characterized the industry until the 1970s (Elsom-Cook, 2001, pp. 83,122), Microsoft capitalized on the idea of creating a virtual desktop with actions represented by visual icons with which the user already had an established association. In keeping with this type of intuitive design, I recommended to Carmen Zirbel that American Data consider basing some of the ECS visual features on pre-established systems at St. Joseph's; for example, there is a culture of color-coding commentary on paper charts such that doctors' notes are in red and nurse notes in blue. While ECS was resistant to the idea that their tabular system was not taking full advantage of an already established learning curve by using a similar orientation and color scheme on the tabs, ECS was very receptive to the idea of color-coding commentary, as a carry-over visual clue from paper charting. While the electronic system should not merely by a replication of the paper system, it makes little sense to intentionally do away with convenient, established/learned techniques where the organizational systems are nonetheless similar. It should be possible to use simple technology to lure technophobes into the program without being so simplistic that the paper is merely replaced by the technology, or that the user is confused or underestimated (Tognazzini, 1992, p. 12). Of course, to balance this perspective, it is important to remember that learning should not replace actual doing (Ciborra, 1997, p. 111). A carry over complaint from Dairyland logins at the front desk computer resulted in specific requests that ECS limit both initial and repeated login steps. Biometric techniques exist and are used in other hospitals, and could be a future possibility at St. Joseph's. Table 9.3 shows a summary of employee suggestions for the computerized IS interface.

Interface Suggestions
vertical, not horizontal scrolling
24-hour time
limited login steps
color coded tabs
clear exit button
patient charts organized by name and room

Table 9.3: Interface Suggestions

Chapter 10

Conclusion

Information systems may generally be described as the organization of a web of task chains into a functional production lattice, where the specific tasks chains may be industry or company specific. This interweaving of task chains requires "collaborative interaction" to coordinate multiple human and non-human actors (Suchman and Trigg, 1991, p. 73). Effective coordination is essential to limiting inefficiencies and unnecesary redundancies, and requires inbuilt prevention against human-related errors. When an information system is not performing in the way desired, it may be necessary to reorganize work routines or even fundamentally shift the artifacts available to the human elements of the production lattice. Inefficiencies and the need to re-design information systems are problems evident in most any organization where there exists a need for real-time communication flow, coordinated human activity, and processing of the communicated information. Via literature review and a case study that may be generalized to the larger problem area, this thesis offers suggestions for how to identify unproductive inefficiencies and potential areas for human-related error, how to then decide which of the identified unproductive inefficiencies are to be removed, and finally, how to go about enacting change to the work routines and coordination of the human component.

While mistakes are undesirable in any line of work, in certain industries mistakes are dangerous and even deadly; and it is essential that risk of error be made as

minimal as possible. Competent practice occurs when error potential is minimized, and work routines are no longer inefficient and cumbersome but simple and straightforward. Of course, some inefficiencies may be maintained in order to increase the number of check-points that critical information must pass through before that information is considered safe for use. One answer for how to identify unproductive inefficiencies and error potential is to use an ethnographic study (Schultze, 2000) that allows human input and brings the designer closer to those who do or will use an artifact (Suchman and Trigg, 1991, p. 74). By conducting an ethnographic study, problems due to the difference between standards and practice—or even a lack of standards—may become apparent where they are currently overlooked. And by allowing individual actors in the production lattice to provide insight into the routines in which they are involved and coordinate with others, it should be possible to make adjustments so that roles and routines are modified to better complement one another (Akrich, 1992). If this reshaping process is successful, then coordination between actors should improve.

Suchman and Trigg (1991, p. 73) explain that "work practice is fundamentally social," and "This basic sociality recommends that wherever we go we look for the human interactions that make up the work and define what counts as competent practice." It therefore follows that the social element of work interactions is an innate and implicit element of coordinated work routines, and an important element to consider before enacting changes. Any new information system that attempts to remove or possibly even limit social interaction is therefore unsound. Furthermore, it invites failure as it requires those whose work is being reorganized to give too much to ensure the success of something with which they are not yet familiar. Moreover, social interaction that is accompanied by individual work may actually aid information flow by offering multiple communication channels and increased opportunity to discuss and recognize potential problems. Then when inefficiencies are identified and a reorganizational process is undertaken to remove them, it is essential that the source of the organizational problems is actually that which is removed (Hartswood et al., 2003, p. 241). The subsequent effect that removal may have on other work routines is ideally recognized and taken into consideration before changes are made so that a negative domino effect might be thwarted. Once

apparent problem routines are identified, then a plan for how to enact change must be determined.

This thesis proposes that inefficiencies be classified by degree of inefficiency, by how easily they can be modified or removed, and the likelihood that an inefficiency can be improved. When these aspects are evaluated together, either they will indicate a positive return of value (measured by intended and desireable change) or they will not. At that point it might then be wise to take advantage of the intrinsic human social drive by introducing change to one group of workers and, once that change achieves acceptance and use within that group, to introduce the change to other groups as well (Orlikowski, 1992, p. 369). This research might be extended in the future to examine how workers' innate social drives affect their incentives for relaying information, and specifically how individual notes and cheat sheets are either excluded from the information system or are included in some revised or reformatted manner.

Appendix A

Scanned Documents

NOTE: All personal information will be held in confidentiality.

PURPOSE: I am a Master's student in Human-Computer Interaction at a Norwegian university. As you know, St. Joseph's has agreed to be a beta-site for the development of ECS (Electronic Chart System) in hospitals. Introducing any new system is, of course, a challenge both to those that use the system as well as for management. My role here is to determine what might ease the transition and make the end product a more satisfactory and functional one for users, management, and the patient.

Name / Age (optional)	Title	Years in healthcare / Years at St. Joseph's

STAGE 1: (OPERATIONS AND COMMUNICATIONS)

Individual Responsibilities:
What are your charting responsibilities?
- Where do you typically record/store information?
- Do you hand write everything first and then copy it over to a machine?
- (Are dictation machines available? If so, available to whom?)

When do you typically work?
- What time of day do you think is most busy?
- What does that mean to you?
- Would you describe your work as autonomous or heavily reliant on others? (1-5)
- What does this mean (more patients, more staff meetings, or…)?

Do you have a pattern of quieter periods where you can update information or take care of tasks you haven't had time for?

How do you exchange job-related information with others?
- Does your primary communication occur via paper, computer, or by speaking?

Communication Flow:
Can you describe the flow of communication to/from your job to/from other jobs?

Are you satisfied with the way communication functions at St. Joe's?
- What could be done to improve communication?
- Does the current flow of information result in missing data, etc.?

What inefficiencies exist in the current way of operating?
- Does double-charting occur?
- Do you think that change is necessary?

Decision-Making:
Do you think management is interested in your opinion?

Was your opinion solicited in the process which led to selecting ECS?

Do you think your input would be valuable?

Figure A.1: Interview Template, page one of two

System Preconceptions:
Do you think you have a clear picture of what ECS is?
Do you think ECS is a good idea?

Do you think ECS will be successful?
What do you think success includes?
What personal or organizational goals might ECS fulfill?

Are you nervous about the introduction of ECS?

STAGE 2: (TECHNICAL COMPETENCE)

At what age did you first use a computer?

Do you have a computer at home?
How often do you use it?
Has it ever needed repair?
What was wrong with it?

What programs are you comfortable using?
How capable are you on these programs?

Do you prefer using a computer to hand-writing notes?

How do you feel about using a new program?
Are new programs intimidating?

STAGE 3: (TRAINING)

How much training do you think will be necessary?

What would be the best way to train staff?
Would you rather be trained in a small group or one-on-one?
Would you be in favor of one-on-one training by a pre-trained co-worker?
Would you prefer an ability-based group or random selection?
Would you prefer self-selection into these ability based groups?

Do you think any of your co-workers would react negatively if it is the youngest employees that adapt most quickly to ECS?
What if the youngest employees were to be trainers?

What types of problems do you think could occur during training?

STAGE 4: (CONCLUSION)

Do you have anything to add?

Is there anything you would like to ask me?

What question should I have asked you that I didn't?

Figure A.2: Interview Template, page two of two

SJCHS NURSING ADMISSION ASSESSMENT

Admit Diagnosis

INITIAL ADMITTING DATA

Date ____ Time ____ Mode ____

BP ____ P ____ R ____ T ____

Ht: ____ Wt: ____ B S C

Name Preferred:

Has Advanced Directive [ ] Y [ ] N
If "Yes" Copy in chart [ ] Y [ ] N
[ ] Advanced Directives Information Given
[ ] Pt. Rights & Responsibilities Given

SOCIAL ASSESSMENT

Living arrangements:

Social Assessment: Will any of your spiritual/cultural beliefs be interfered with this hospitalization? (Blood transfusions, communion, etc)

Social habits: Alcohol use:
Tobacco use:
Rec/drug use:
Caffeine use:
Alcohol use:

Financial concerns re: Hospitalization:

Support services utilized:[ ]Care line[ ]Home health

EDUCATIONAL ASSESSMENT

Barriers to learning, vision, literacy, communication (language, limited vocabulary) other:

What is the best way for you to learn: pictures, ideas, read, listen, demo, other…:

Do you have any specific educational needs at this time?

NUTRITION SCREENING

Diet Order ____ DX ____ (1)

___ Difficulty Swallowing (2) Chewing Prob. (2)
___ Texture Modified or Therapeutic Diet (3)
___ Diarrhea or vomiting (2) ___ Nausea (1)
___ Appetite (poor 2, fair 1 good 0)
___ Slow healing open wound (4)
___ PO Supplement (1)
___ TPN/IVF (2)
___ Serum Albumin <2.6 (4)
___ Calorie count (1)
___ Wt.Loss >10# in past 6 months, unintentional (3)
___ Age > 65 years (1)
___ Recent Surgery (1)
___ Lactation (1)
___ Preg. < 18 years (4)
___ Hyperemesis Gravidarum (4)
___ Fewer than 2 meals per day (1)
NPO and/or clear liquid > 3 days (1)

TOTAL POINTS ___

Functional Screening S=Self, A = Assist, D=Depend	S	A	D
Transfers			
Shopping/Cleaning/Laundry			
Toileting			
Eating			
Meals prepared			
Other personal devices: Care			
Walking/Stairs			
Bath/Shower			
Dressing			
Transportation			
Equipment used			

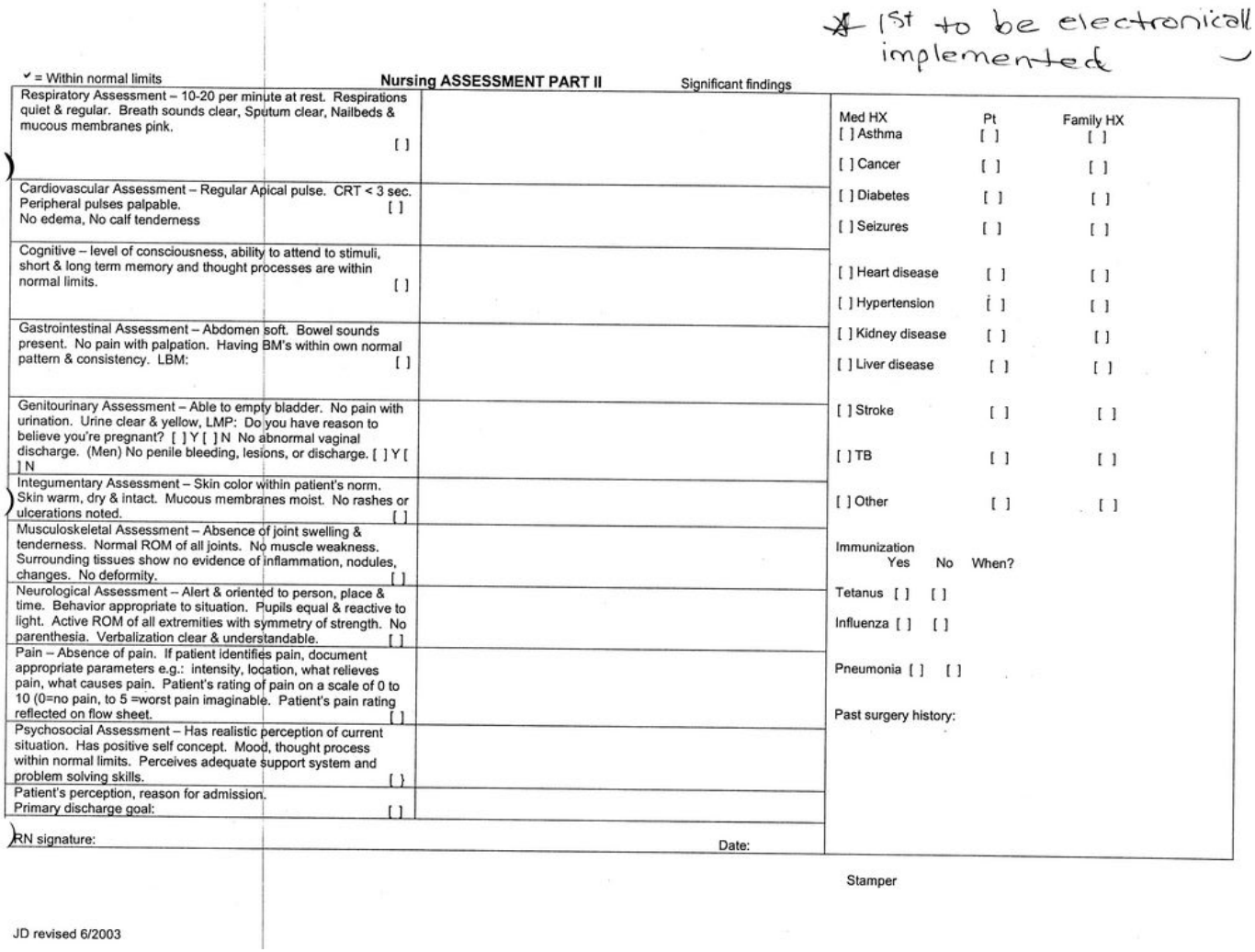
Allergies & Sensitivities: (signs & symptoms)

Med/Dose	Prescription/OTC	Last dose

Pt's Pharmacy
Disposition of Meds
RN Signature:

Stamper

Figure A.3: Nursing Admission Assessment, page one of two



✓ = Within normal limits

Nursing ASSESSMENT PART II

Significant findings

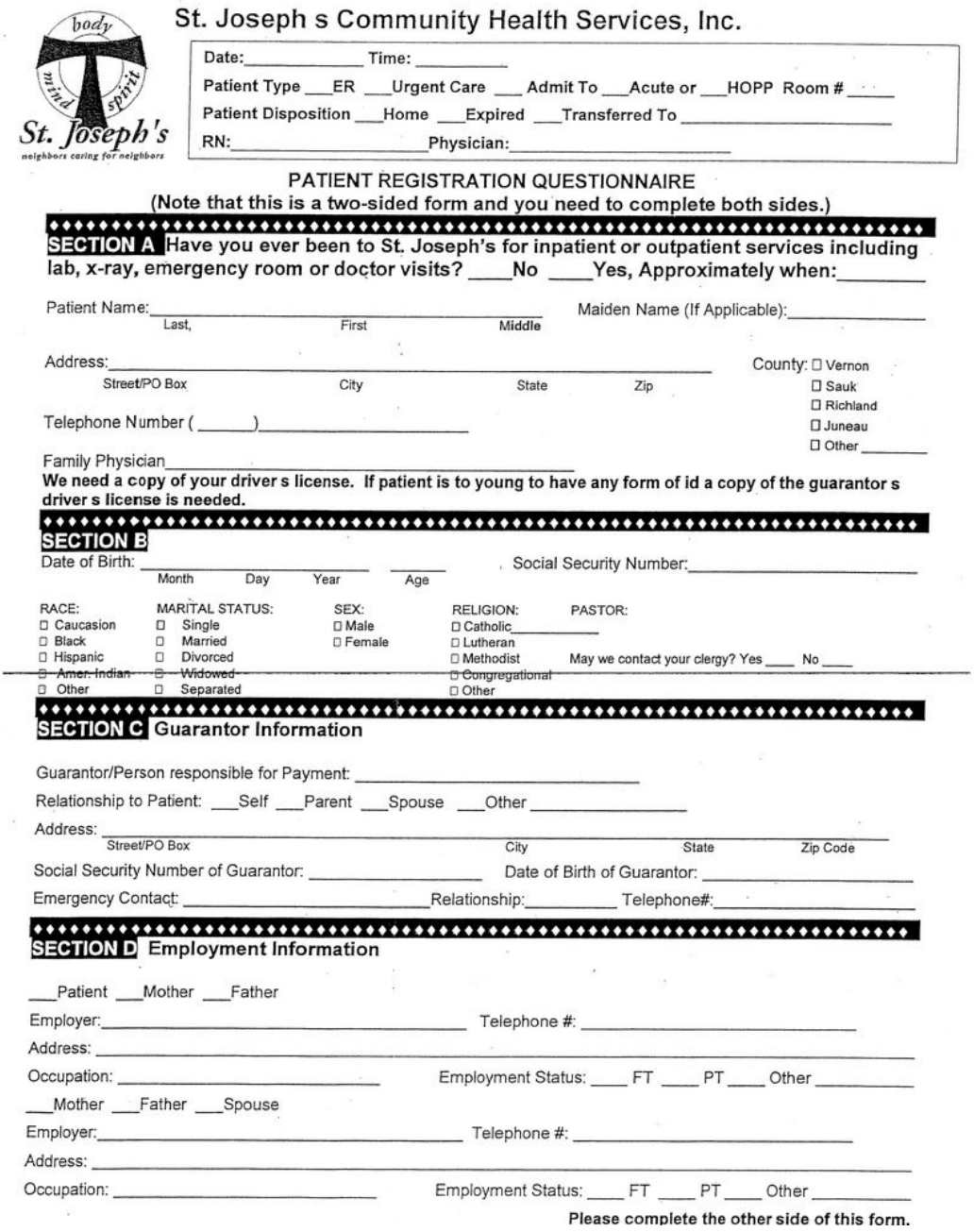
1st to be electronically implemented

Respiratory Assessment – 10-20 per minute at rest. Respirations quiet & regular. Breath sounds clear, Sputum clear, Nailbeds & mucous membranes pink. [ ]		Med HX / Pt / Family HX [ ] Asthma [ ] [ ] [ ] Cancer [ ] [ ] [ ] Diabetes [ ] [ ] [ ] Seizures [ ] [ ] [ ] Heart disease [ ] [ ] [ ] Hypertension [ ] [ ] [ ] Kidney disease [ ] [ ] [ ] Liver disease [ ] [ ] [ ] Stroke [ ] [ ] [ ] TB [ ] [ ] [ ] Other [ ] [ ]
Cardiovascular Assessment – Regular Apical pulse. CRT < 3 sec. Peripheral pulses palpable. No edema, No calf tenderness [ ]		
Cognitive – level of consciousness, ability to attend to stimuli, short & long term memory and thought processes are within normal limits. [ ]		
Gastrointestinal Assessment – Abdomen soft. Bowel sounds present. No pain with palpation. Having BM's within own normal pattern & consistency. LBM: [ ]		
Genitourinary Assessment – Able to empty bladder. No pain with urination. Urine clear & yellow, LMP: Do you have reason to believe you're pregnant? [ ] Y [ ] N No abnormal vaginal discharge. (Men) No penile bleeding, lesions, or discharge. [ ] Y [ ] N		
Integumentary Assessment – Skin color within patient's norm. Skin warm, dry & intact. Mucous membranes moist. No rashes or ulcerations noted. [ ]		
Musculoskeletal Assessment – Absence of joint swelling & tenderness. Normal ROM of all joints. No muscle weakness. Surrounding tissues show no evidence of inflammation, nodules, changes. No deformity. [ ]		Immunization Yes No When? Tetanus [ ] [ ] Influenza [ ] [ ] Pneumonia [ ] [ ]
Neurological Assessment – Alert & oriented to person, place & time. Behavior appropriate to situation. Pupils equal & reactive to light. Active ROM of all extremities with symmetry of strength. No parenthesia. Verbalization clear & understandable. [ ]		
Pain – Absence of pain. If patient identifies pain, document appropriate parameters e.g.: intensity, location, what relieves pain, what causes pain. Patient's rating of pain on a scale of 0 to 10 (0=no pain, to 5 =worst pain imaginable. Patient's pain rating reflected on flow sheet. [ ]		Past surgery history:
Psychosocial Assessment – Has realistic perception of current situation. Has positive self concept. Mood, thought process within normal limits. Perceives adequate support system and problem solving skills. [ ]		
Patient's perception, reason for admission. Primary discharge goal: [ ]		
RN signature:	Date:	

Stamper

JD revised 6/2003

Figure A.4: Nursing Admission Assessment, page two of two



St. Joseph s Community Health Services, Inc.

Date:_____ Time: _____

Patient Type ___ER ___Urgent Care ___ Admit To ___Acute or ___HOPP Room # _____

Patient Disposition ___Home ___Expired ___Transferred To _____

RN:_____Physician:_____

PATIENT REGISTRATION QUESTIONNAIRE

(Note that this is a two-sided form and you need to complete both sides.)

SECTION A Have you ever been to St. Joseph's for inpatient or outpatient services including lab, x-ray, emergency room or doctor visits? ____No ____Yes, Approximately when:_____

Patient Name:_____ Maiden Name (If Applicable):_____
Last, First Middle

Address:_____ County: ☐ Vernon ☐ Sauk ☐ Richland ☐ Juneau ☐ Other _____
Street/PO Box City State Zip

Telephone Number (_____)_____

Family Physician_____

We need a copy of your driver s license. If patient is to young to have any form of id a copy of the guarantor s driver s license is needed.

SECTION B

Date of Birth: _____ _____ Social Security Number:_____
Month Day Year Age

RACE: ☐ Caucasion ☐ Black ☐ Hispanic ☐ Amer. Indian ☐ Other

MARITAL STATUS: ☐ Single ☐ Married ☐ Divorced ☐ Widowed ☐ Separated

SEX: ☐ Male ☐ Female

RELIGION: ☐ Catholic ☐ Lutheran ☐ Methodist ☐ Congregational ☐ Other

PASTOR: May we contact your clergy? Yes ____ No ____

SECTION C Guarantor Information

Guarantor/Person responsible for Payment: _____

Relationship to Patient: ___Self ___Parent ___Spouse ___Other _____

Address: _____
Street/PO Box City State Zip Code

Social Security Number of Guarantor: _____ Date of Birth of Guarantor: _____

Emergency Contact: _____Relationship:_____ Telephone#:_____

SECTION D Employment Information

___Patient ___Mother ___Father

Employer:_____ Telephone #: _____

Address: _____

Occupation: _____ Employment Status: ____ FT ____ PT ____ Other _____

___Mother ___Father ___Spouse

Employer:_____ Telephone #: _____

Address: _____

Occupation: _____ Employment Status: ____ FT ____ PT ____ Other _____

Please complete the other side of this form.

Figure A.5: Patient Registration Questionnaire, page one of two

SECTION E Please describe the reason that you are being seen at the facility (i.e. stomachache, sore throat, pain in arm): _____

Is your visit to St. Joseph's the result of an accident: ☐ Yes ☐ No

Place accident occurred: _____ Date/Time of accident: _____

SECTION F Do you have health insurance coverage?:

____Yes, Continue to Section G and complete all insurance information.

____ No, Services for this hospital visit will be considered self pay. Please contact a Patient Account Representative to arrange for payment of services.

SECTION G

INSURANCE INFORMATION – It is vital that this information is obtained for proper submission of your claim. Please complete this section carefully and have insurance cards available for copying. Thank you!

☐**Medicare Number**: _____ **AARP #**: _____

☐**Medicaid Number**: _____ **Atrium #**: _____

☐**Worker s Compensation**: _____ Claim Number: _____

☐**Commercial Insurance**:

Policy Holder's Name: _____ Date of Birth _____

Policy Holder's Relationship To Patient: _____

Insurance Company: _____

Insurance Address: _____ Telephone #_____

Insured's Identification #: _____ Group/Policy #: _____

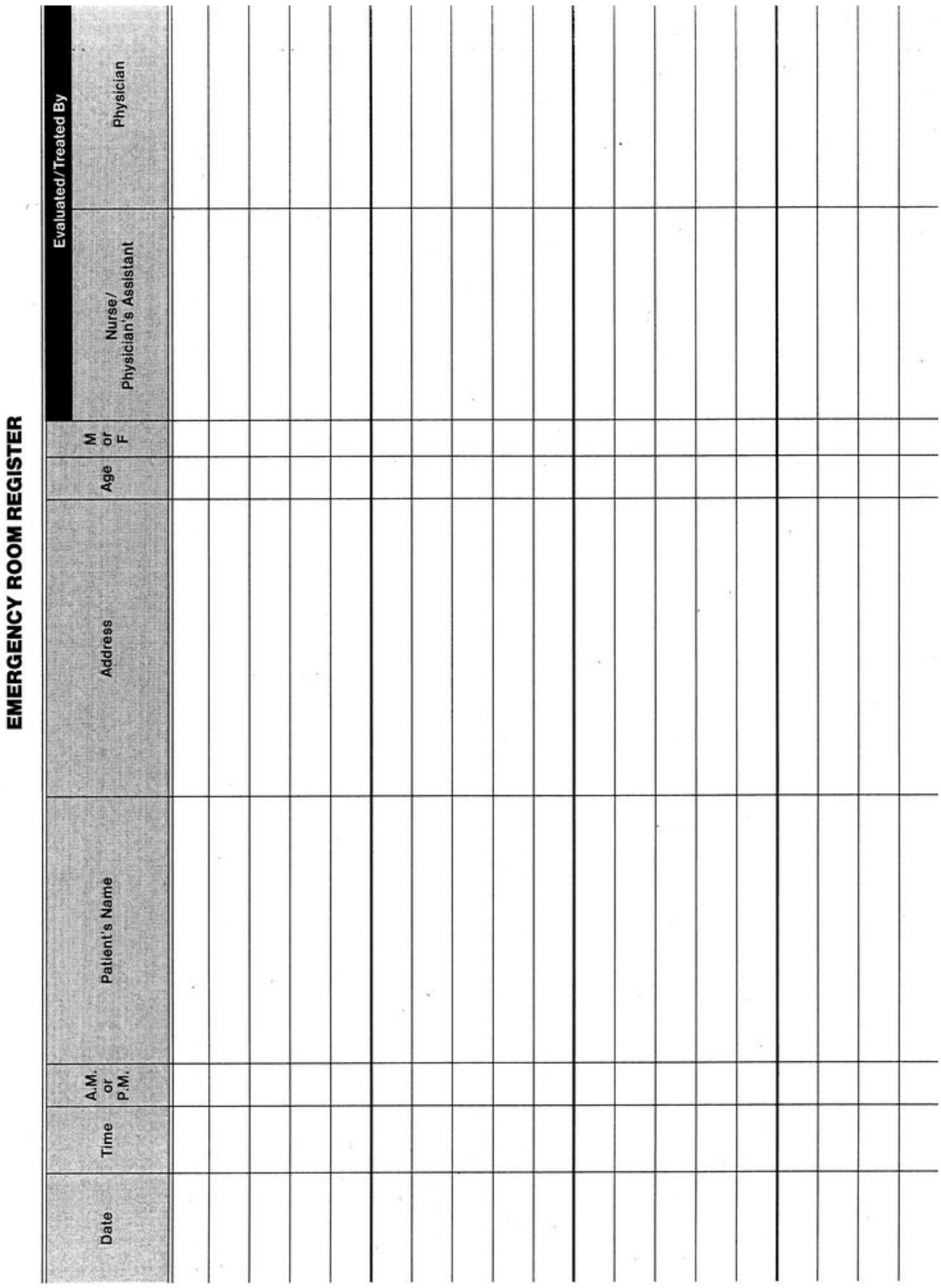
NOTE: St. Joseph's has personnel that can assist you with pre-certification through your insurance company for hospitalization and/or surgery. If you would like assistance with this process, please note that pre-certification is required and record the telephone number to call:

_____Not needed _____Yes, I would like assistance with this process. The telephone # to call is (this is usually located on your insurance card): _____

Thank you for taking the time to complete this registration form. If you have any questions regarding any of the information contained on this form, please asked any of our hospital personnel and they would be happy to assist you. Please sign this form and return to the nurse.

Person Completing Form: _____

Figure A.6: Patient Registration Questionnaire, page two of two



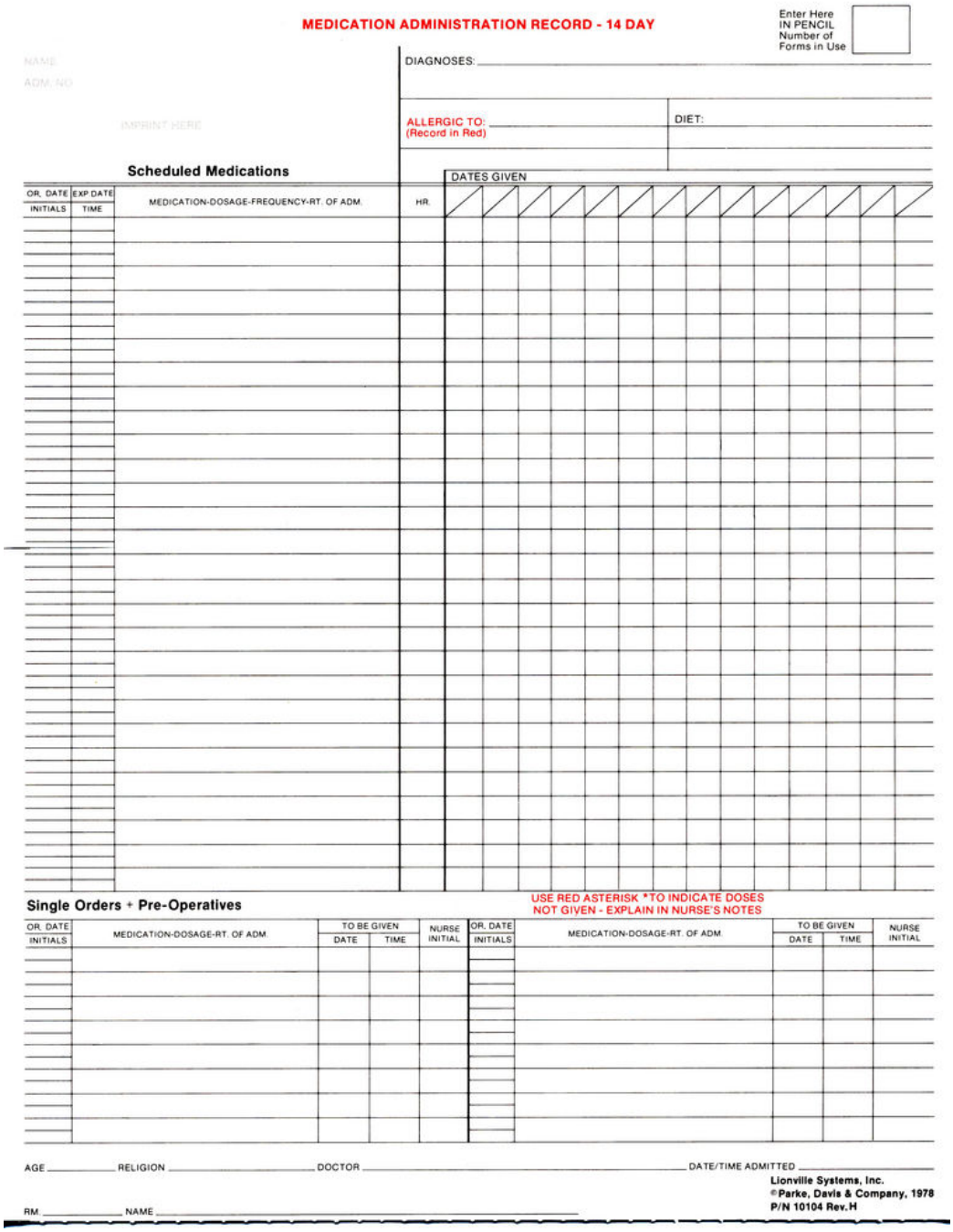
EMERGENCY ROOM REGISTER

Date	Time	A.M. or P.M.	Patient's Name	Address	Age	M or F	Evaluated/Treated By: Nurse/ Physician's Assistant	Evaluated/Treated By: Physician

Figure A.7: Emergency Room Register, page one

Patient Name/Doctor	Age /Allergies	Diagnosis/hx	Code	VS	O2/Sat	IV/Meds	Activity	Diet	I & O	Labs	Comments
OB				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
105				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
106				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
106-2				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
109				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
109-2				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
110				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
110-2				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		
111				Freq.:	O2		PT OT		I		
Admit-					per				O		
Doc.-				WT	SPO2				Drains		

Figure A.8: Main Report/Nurse Cheat Sheet, page one



MEDICATION ADMINISTRATION RECORD - 14 DAY

Enter Here IN PENCIL Number of Forms in Use

NAME
ADM. NO.
IMPRINT HERE

DIAGNOSES:

ALLERGIC TO: (Record in Red)

DIET:

Scheduled Medications

OR. DATE INITIALS	EXP. DATE TIME	MEDICATION-DOSAGE-FREQUENCY-RT. OF ADM.	HR.	DATES GIVEN

Single Orders + Pre-Operatives

USE RED ASTERISK *TO INDICATE DOSES NOT GIVEN - EXPLAIN IN NURSE'S NOTES

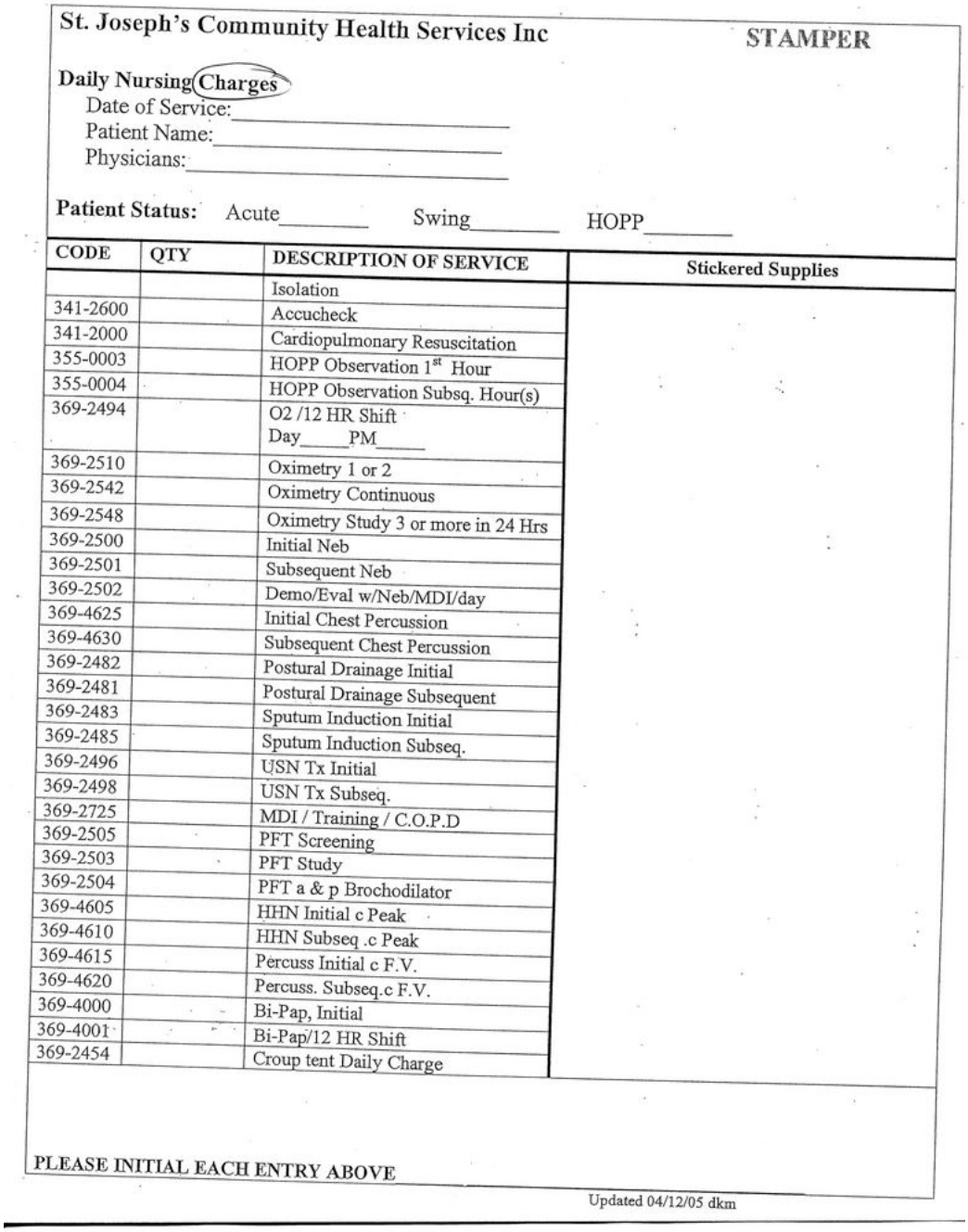
OR. DATE INITIALS	MEDICATION-DOSAGE-RT. OF ADM.	TO BE GIVEN DATE	TO BE GIVEN TIME	NURSE INITIAL	OR. DATE INITIALS	MEDICATION-DOSAGE-RT. OF ADM.	TO BE GIVEN DATE	TO BE GIVEN TIME	NURSE INITIAL

AGE _____ RELIGION _____ DOCTOR _____ DATE/TIME ADMITTED _____

RM. _____ NAME _____

Lionville Systems, Inc.
©Parke, Davis & Company, 1978
P/N 10104 Rev.H

Figure A.9: Medication Administration Record, page one



St. Joseph's Community Health Services Inc STAMPER

Daily Nursing Charges

Date of Service: _____

Patient Name: _____

Physicians: _____

Patient Status: Acute_____ Swing_____ HOPP_____

CODE	QTY	DESCRIPTION OF SERVICE	Stickered Supplies
		Isolation	
341-2600		Accucheck	
341-2000		Cardiopulmonary Resuscitation	
355-0003		HOPP Observation 1st Hour	
355-0004		HOPP Observation Subsq. Hour(s)	
369-2494		O2 /12 HR Shift Day_____PM_____	
369-2510		Oximetry 1 or 2	
369-2542		Oximetry Continuous	
369-2548		Oximetry Study 3 or more in 24 Hrs	
369-2500		Initial Neb	
369-2501		Subsequent Neb	
369-2502		Demo/Eval w/Neb/MDI/day	
369-4625		Initial Chest Percussion	
369-4630		Subsequent Chest Percussion	
369-2482		Postural Drainage Initial	
369-2481		Postural Drainage Subsequent	
369-2483		Sputum Induction Initial	
369-2485		Sputum Induction Subseq.	
369-2496		USN Tx Initial	
369-2498		USN Tx Subseq.	
369-2725		MDI / Training / C.O.P.D	
369-2505		PFT Screening	
369-2503		PFT Study	
369-2504		PFT a & p Brochodilator	
369-4605		HHN Initial c Peak	
369-4610		HHN Subseq .c Peak	
369-4615		Percuss Initial c F.V.	
369-4620		Percuss. Subseq.c F.V.	
369-4000		Bi-Pap, Initial	
369-4001		Bi-Pap/12 HR Shift	
369-2454		Croup tent Daily Charge	

PLEASE INITIAL EACH ENTRY ABOVE

Updated 04/12/05 dkm

Figure A.10: Daily Nursing Charges

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