Scandinavian Journal of Information Systems

Volume 17 | Issue 1 Article 10

2005

Subtle Redistribution of Work, Attention and Risks: Electronic Patient Records and Organisational Consequences

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Abstract. Based on an actor-network study of the way in which medical work in a hospital has changed after the introduction of an electronic patient record system, the paper addresses the question of organisational consequences of ICT. It describes how the introduction of electronic patient records (EPR) has occasioned redistribution of work, of organisational attention, and of risks. By comparing these findings to the public expectations of EPR and to the literature on organisational effects of EPR, it is argued that we need to shift from a theory of improvement to a theory of distribution in order to understand the way in which ICT affects work practices. The paper further argues that this shift also has implications for the theoretical understanding and practical management of design, implementation, and evaluation of ICT.

Key words: ICT, electronic patient record, medical informatics, organisational consequences, work, risk

1 Introduction

Over the last few years, hospitals have invested vastly in electronic patient records (EPR). These investments are typically directed at developing a *seamless healthcare*, where information supposedly flows freely and services are integrated across organisational boundaries. It is expected that properly implemented EPR will lead to: a) improved inter-organisational coordination by smooth exchange of patient information across institutions; b) improved intra-organisational efficiency through increasing exchange of information and cooperation among the staff, and greater transparency in the use and allocation of time and resources; and c) higher healthcare quality and less errors by streamlining the production and distribution of clinical information. Only a few have disputed these expectations, and the public debate is preoccupied with strategies for solving technical design challenges and overcoming organisational obstacles in the implementation of EPR.

Research into EPR and medical practice reveals a more complex portrait of the benefits of EPR and of appropriate design and implementation methods. However, scrutinizing literature reflects a shared theory of improvement underlying the concepts of ICT, and organisation, and their interrelationship despite variances in empirical findings. This unquestioned theory risks to make us blind to substantial effects of EPR—effects hard to assess in terms of better or worse.

In this paper I present findings from an empirical study of an electronic patient record system in a medical ward. The findings provide insight into the more serious consequences of introducing EPR in hospitals. I describe how the introduction of an EPR-system transforms four kinds of organisational activities and point to the difficulty of measuring these transformations in terms of improvement, efficiency, or support. Therefore such transformations should rather be measured in terms of altered work practices, refocused organisational attention, and new kinds of risks. This calls for a shift from a theory of improvement to a theory of distribution, which is already heralded by the constructionist view on technology and organisation. However, I conclude that this can be elaborated theoretically on basis of my findings, and that we need to dig further into its implications for the design, implementation and evaluation of ICT.

2 Literature review

In order to address the study's theoretical contribution, let me describe how ICT and organisation are conceptualised in three different fields of research into the question of EPR and organisational consequences.

Within the field of *medical informatics*, EPR is depicted as a crucial tool for collecting and integrating medical information in order to improve clinical decision-making (Weed 1991; Hannan 1999), teamwork and patient focus (Nøhr et al. 2001), continuity of care (Iakodovis 1998), healthcare administration (Müller et al. 2003) meeting new patient demands (Grimson 2001; Ueckert et al. 2003). Yet it is recognized that EPR have proven more difficult to implement than expected and only limited progress has been achieved so far (Kay 1999; Safran et al. 1999; McDonald 1997; Andersen et al. 2002). This state of affairs has been explained by various factors: cultural, organisational and legal lack of support to the idea of sharing information; poor user education; lack of software, appropriate system architecture, and standards; absent strategies for utilizing the potential of the technology by business process re-engineering; and too little focus on patient-centered information processing (Sujansky 1998; Iakovidis 1998; Grimson 2001; Elberg 2001; Haux et al. 2002; Nøhr et al. 2001). The literature reflects the common notion of EPR as delimited and singular technologies, which must include certain attributes or requirements in order to control and facilitate specific business processes. Likewise, hospitals are seen as organisations that must be configured in special ways to utilize the potentials of the technology. Organisational impact is thus conceptualised as a matter of fit between technology and organisation, which leads to improvement of overall business performance.

EPR have also been studied within the tradition of *computer supported cooperative work* (CSCW). Here, focus is on the way in which EPR support daily practices, which is explored through ethnographic studies of work sites. This research yields somewhat different conclusions regarding the impact of EPR. Schneider & Wagner (1993) find that an EPR-system in a hospital supports collaborative work by enlarging and enriching the area of shared information, providing actors with an overview of information distributed over space and time, supporting the negotiation of norms and rules, facilitating the coordination of effort, and helping to establish a certain degree of discipline and rigor. Yet the authors stress that these effects may depend on the extent to which the actors form shared representations of reality across the organisation (Schneider & Wagner 1993: 248). In contrast, other researchers find that hospital physicians' usage of EPR is minimal (Lærum & Ellingsen 2001), and that a hospital EPR-system only results in a few organisational changes compared

to the initial ambitions (Ellingsen & Monteiro 2003b). They argue for the importance of determining to what degree EPR should be integrated and standardized with other information systems in order to foster collaboration and local practices (Ellingsen & Monteiro 2003a). Hartswood et al. also report discrepancies between the assumed role of EPR in integrating services and the daily healthcare practices. They argue that the technology will only deliver its potential benefits if there is an "effective integration of computer systems with existing, localised work practices, while allowing space for the development of new ones" (Hartswood et al. 2003, p. 263). Also Atkinson & Peel (1998) find this call for user-focused and incremental design and implementation of EPR. And in related studies of picture archiving and communication systems (PACS[1]) Lundberg & Tellioglu argue that the technology must be designed to "fit the properties of various kinds of coordination work" (Lundberg & Tellioglu 1999) in order to become an effective tool for coordinating work practices. In sum, CSCW-research sees EPR as tools for information sharing and collaboration in the organisation, but argues that EPR must be tailored to fit the needs of the users and the contingencies of medical work in order to have this impact. Thus, this research also employs a distinction between technology and organisation and a notion of fit as explanatory of successful outcome. Yet unlike the medical informatics tradition, CSCW-research rejects the idea of the organisation as a uniform entity and argues that the ultimate benchmark of success is whether the ICT improves and supports practices at the shop-floor level of the organisation.

Finally, *science and technology studies* (STS) have addressed EPR and organisational consequences, explicitly questioning the ambition of evaluating effects and developing best practices on basis of certain standards. Instead this research focuses on the way in which EPR have become constitutive of the healthcare field and modern rational medicine by, for instance, accumulating and coordinating data (Berg 1997, 1999), by feeding into the production of discharge letters (Ellingsen & Monteiro 2003c), and by allowing general practitioners to code and make accounts of their practice (Winthereik 2003). These analyses describe how EPR come to work through the enmeshment with a multitude of other entities, such as health care professionals, standards, and artefacts, which are simultaneously shaped through these relations. In this vein others are focusing on the strategic processes of introducing EPR into the healthcare field. Such processes are analysed as networks characterized by stability and institutionalisation (Hanseth & Monteiro 1998), distributed production of broad visions (Jensen &Winthereik 2002), and battles among system models, vendors, and public institutions (Ellingsen & Monteiro 2003b). These kinds of analyses argue that technology and organisation cannot be separated,

but are co-constructed. In effect, implementation must be considered as a process in which both technology and organisation are transformed in unpredictable ways through their interlocking, and where it is problematic to single out critical success and failure factors (Berg 2001; Jones 2003). Likewise organisational impact is an equivocal issue, which cannot be measured by standards such as support/non-support, because entirely new effects arise, which are not easily evaluated (Berg 1999, 2001). Therefore, design and implementation cannot be pre-planned and centrally orchestrated, but must be seen as processes of experimentation, political negotiation, and inventiveness (Berg & Toussaint 2003; Zuiderent 2002). Accordingly, the STS-literature calls for more research into the deeper qualitative *ontological* changes occasioned by the introduction of EPR, rather than trying to measure the impact of EPR and the best practices regarding design and implementation based on seemingly universal standards. Here, we may draw inspiration from research into PACS and its influence on the transformation of work practices and professionals. Thus, Lundberg points to changes in professional roles and responsibilities, in relations among staff towards more individualized working patterns, in needs for new skills, and in the role of other tools such as lists (Lundberg 1999). Yet by concluding that PACS have improved efficiency of various activities, while the overall efficiency is hard to estimate, the study leaves the ambition of depicting the larger socio-technical reconfigurations brought about by the ICT and continues the tradition from medical informatics and CSCW of summing up the impact in terms of efficiency, without reflecting on the contested nature of a standard like this. In sum, the STS-tradition advances a constructionist, non-essential view on technology and organisation as illustrated in many focused studies of specific practices. However, only preliminary attempts have been made at describing the larger effects of EPR on healthcare without resorting to essentialist, or normative evaluations.

3 Research Approach

The empirical study was conducted within the framework of actor-network theory, which, like many STS-studies, implies a constructionist ontology. One of the basic premises is that neither technology nor organisations or humans are distinct and definable entities, but are fundamentally entangled with each other in networks and gain their specific qualities through these relations (cf. Latour 1992, 1999; Law 1994; Akrich 1992). The concept of translation is central in order to understand how these specific qualities emerge and change. The basic point is that whenever an entity, human or non-human, is removed

from or added to a network, the characteristics of the network as well as the specific entity are subtly or radically changed—they are translated (Latour 1991; Callon 1986). Although a technology is designed to bring about certain effects, the specific relations it enters thus determine its actual capability. If we want to investigate such translation processes (e.g., the effects of the introduction of an EPR-system in medical practice) we should, therefore, not define entities a priori, but follow empirically the way in which entities are linked in practice and look for the effects arising from these linkages.

This methodological principle has been governing my study. Its overall aim was to explore the way in which the introduction of an EPR-system affected the medical practice in a hospital ward. The EPR-system was introduced in mid-1999 and the study began half a year later in order to explore the daily use rather than implementation aspects. Data was constructed in two steps. The first step was to explore the way in which medical practice was performed with the EPR-system—a now-focus. Within a period of four months I followed four physicians, four nurses, and three secretaries on their duties, all in all ninety hours of observation. These people were chosen in order to cover the different kinds of duties performed in the ward: day, evening, and night duties for nurses and secretaries; and physicians' front stage duty[2] and backstage duty[3], and head doctor duties. I observed each person throughout his or her duty, writing down as detailed as possible the line of activity he or she engaged in during the duty (e.g., meeting on duty, reading and writing documents on patients, encountering patients, attending conferences, discussing with colleagues, etc.). The aim was to track down how work tasks were defined, handled, and negotiated through a multitude of socio-material relations (including the EPR-system) during the duties. This entailed also gathering and later on analysing different documents and artefacts employed in the observed duties, and taking photographs to remember the layout of workspaces. I analysed the field-notes following the basic steps of grounded theory (Strauss 1987) in order to depict the collective accomplishment of tasks such as medication and record-making. From these analyses I made a number of elaborate descriptions of basic workflows in the medical department. The next step was to generate data about the way in which work was carried out prior to the introduction of the EPR-system. The aim was to be able to compare the socio-material particularities of earlier practice with that of the present. Thus, it was important not to reconstruct the past through normative evaluations, but through the staffs' description of earlier procedures and socio-technical arrangements. This was done through a special interview procedure. To each of the eleven interviewees, whom I had observed, I sent selected workflow descriptions. I instructed them to read the descriptions carefully and: (a)

reflect upon whether these were typical of their usual work or were exotic, special cases; and (b) reflect upon how comparable tasks were handled before the EPR-system. I then arranged an interview with each person. Here the specific workflow descriptions worked to structure a systematic interview about the concrete workflows before the EPR-system (e.g., "how exactly would you make a prescription earlier?" and "how would the nurse then come to know about the prescription?") The interviews were taped and transcribed. I subsequently analysed the interviews in order to create similar descriptions of earlier workflow. The two steps made it possible to compare the way in which specific tasks were accomplished before and after the introduction of EPR, and single out areas within which the relations among socio-material entities had changed. The aim was not to make a normative evaluation of practices as to whether they were now better or quicker, but to compare the socio-material constitution of the organisational network before and after the introduction of EPR.

Before presenting the empirical findings, let me briefly present the field of study and the specific EPR-system. X Hospital is located in Denmark and has 189 beds distributed on a surgical ward, a psychiatric ward, and a medical ward. The medical ward comprises a Reception Ward, where new patients are placed the first 24 hours, and five specialized medical wards. Each special ward holds from ten to twenty patients. The department introduced the EPR-system in 1999. From day one, new patient records were drawn up electronically and old ones continued electronically. 175 workstations were set up and 419 people defined as users (physicians, nurses, aides, secretaries, physiotherapists, ward managers, and systems operators). The EPR-system is a shared, multidisciplinary record-system. All users can access all information, and the system comprises all patient notes made by occupational groups in the hospital. It is integrated with two other information systems: the Edifact system and the patient administrative system. An electronic patient record consists of a front-page with basic patient data and a number of folders: nursing notes, progress notes, physiotherapist notes, medicine scheme, laboratory figures, prescription sheet, diagnosis scheme, and X-ray reports. It also includes general folders that, for example, list the patients hospitalised at each ward and the patients scheduled for physiotherapy. Pictures, such as X-ray pictures, and external notes about the patient, such as referral letters, cannot enter the EPR-system, but are kept temporarily in plastic folders in the specific ward offices. When a patient is discharged, the content of the plastic folder is sorted out and some of it filed away.

4 Changes in Work and Professional Roles in a Medical Department

What happens when EPR come to work as integral parts of daily work practices in a medical ward—when the technology and the staff have overcome the initial difficulties with breakdowns and other exasperating events, and a new working order begin to emerge? Let me describe some important changes in four aspects of the daily business in the ward: the writing and reading of progress notes; the updating and reporting routines of nurses; the distribution of test results; and the medication process. I shall point to the ways in which the EPR-system has occasioned a subtle reconfiguration of work and of roles and relations among physicians, nurses, secretaries, and patients (the analysis is based on a case study, which is presented in greater details in Svenningsen 2003).

4.1 The Writing and Reading of Progress Notes

Each physician treating a patient formulates a note about this, which is added to previous notes. These notes are called progress notes and are the backbone of any patient record. They depict the case history, represent the body as a geography of normal and abnormal areas and numbers, encircle diseases, line up interventions, and deduce the current situation (Berg & Bowker 1997). Thus the progress notes work to delineate the patient as a medical case, and to define and delegate work tasks among healthcare professionals.

The physician would dictate his progress notes for the paper-based patient records and the secretary would subsequently transcribe the notes. This production process implied that several hours might pass before a note was transcribed, because the secretary was busy doing other things. Therefore the record was often on the secretary's desk. Furthermore, only one person at a time could read the record, and sometimes it might be on loan to other wards or simply missing. The physicians had the main claim to the record, and nurses felt they had to have a legitimate motive for reading a record. After the introduction of the EPR-system, most progress notes are still dictated and transcribed by the secretary, but now entered into a physician note folder, which can be immediately accessed from all PCs. This allows the same note to be viewed simultaneously by many readers, and the previous problems of locating the record and negotiating the right to use it have practically vanished. The easier access has, however, also lead to a change in the way progress notes are read and *authored*.

First of all the physicians can now only read the records at the computers in the office and can no longer bring them along on ward rounds unless they make a hardcopy. According to the physicians this has made their work with patient cases more complicated and laborious. Reading the record is now separated from the contact with the patient, which means often moving back-and-forth between patient bed and office. Moreover, it is harder to compare and sort out documents in the EPR-system on screen (see also Heath & Luff 2000). On the other hand, this separation encourages more meticulous preparation of the patient case "to create a mental image of the record," and more direct and unmediated conversation with the patient.

Second, the number of people reading the progress notes has multiplied. Nurses have become keen readers of progress notes. This makes them more aware of the medical agenda to which they align and adjust their activities, but which they also use as a yardstick of the physicians' performance. Nurses comment, for example, on the content of progress notes when meeting the physicians, and they monitor whether decisions are carried out or conflict with other decisions. Thus, the nurses have become informed participants in the formation of medical activities and new progress notes. And medical colleagues are consulting the progress notes too. It is, for example, not uncommon that younger physicians look up notes on exotic or dramatic patient cases that they hear about. A physician may also, when overhearing colleagues' talking about a patient, look up the case in the EPR-system and explicitly question their framing of the patient case. Thus, easier access to patient information expands the circle of readers and the number of indirect participants in the authoring of progress notes, thereby facilitating learning, reflexivity, and professionally negotiated patient cases. But the EPR-system also invites less noble activities, such as prying into cases of famous patients, which has lead to an ongoing debate in the hospital on how to prevent illegitimate readers from accessing patient cases without ruining the possibility for organisational learning and competence development.

A third aspect of the computerization of progress notes concerns the way in which notes are entered. Physicians are now on a small scale writing their notes directly into the EPR-system instead of dictating them to the secretary. In effect, the work of recording notes changes, and the physician is enacting a new role. When dictating the physician usually finds an isolated corner to cut out noise. Often he is standing up and composes the note by skimming record documents and dictating small cut-up fragments into the recorder. When entering notes via the keyboard, in contrast, he sits next to colleagues in front of the computers, and somehow participates in the office life, which means that colleagues' talk about cases and activities are proximal and more easily become

incorporated into the note making. But the physician also becomes an active reader. He sees his own words on the screen as he punches them in, which makes him critically evaluate his own statements and correct errors, ad and delete fragments, and restructure the composition of the small text. In sum, he gets the triple role of author, proofreader, and editor, which, according to some physicians, tends to make notes shorter and more readable. Yet other physicians do not find it rational to spend time on such activities, time that could be better used for other activities, such as reading scientific periodicals and supervising apprentices (Lundberg (1999) finds a similar scepticism among physicians).

With the paper-based record the authoring of a progress note is a distributed and interactive process, in which the physician combines and negotiates his observations with existing statements about the patient. However, with EPR-system the authoring process is protracted as it involves more manoeuvres back-and-forth between humans, tools, and texts. Furthermore, it becomes more distributed and interactive because more actors take active part in the authoring process. This development can be seen as counterproductive of effective clinical decision-making if conceived in an individual-oriented model of information processing. Yet it can also be seen as making decision-making more negotiated, less idiosyncratic, and incorporating more knowledge—and hence more robust—if conceived in a broader model of socio-materially distributed cognition as developed by for instance Hutchins (1995). Although the progress notes are renamed to physician notes in the EPR-system, one of the striking features of the electronic notes seems to be that they involve a wider circle of authors and readers than physicians exclusively.

4.2 The Reporting and Updating Routines of Nurses

In Danish hospitals nurses write notes on all patients. These notes, often called *Kardex*, are structured around *patient problems* under which notes are entered as "goal," "action," or "evaluation." Kardex was introduced in the 1970s for the purpose of strengthening the coordination of nursing activities, but soon it was also considered a tool for documenting nursing activities in order to prove quality and efficiency and become visible as a professional group (cf. Schneider & Wagner 1993; Bowker & Star 1999). But nursing notes are also important as means to coordinate nursing activities across shifts. In this respect, nursing notes are important mediators of the nurses' information work (Strauss et al. 1997).

Before EPR, nursing notes were made in Kardex, a plastic covered index card folder, which was placed in the office or at the patient's table. In the beginning of each duty a nurse from the previous duty gave an oral report, in which she read aloud from Kardex supplemented with verbal comments. During the duty, the nurses would then write new notes and read in Kardex to update themselves on patient cases. Thereby, work was coordinated across shifts and the nurses enacted as a professional community with special tasks and concerns. With EPR, electronic nursing notes have replaced Kardex and are now part of the EPR-system. All users of the EPR-system can now access the nursing notes simultaneously. In addition, nurses edit an electronic patient-list, which shows the patients in the ward with a few keywords about their diseases, certain precautions, and important appointments. Whereas Kardex could be moved, the reading and writing of notes is now physically anchored to the computers in the office. The reporting and updating routines of nurses have subtly changed in a way that creates increasing written interaction among the nurses and a stronger focus on the medical agenda.

First, the problem-oriented structure of Kardex is enhanced, since almost all notes are now subsumed under nursing diagnoses, and the tri-partite structure of goal, action, and evaluation made graphically explicit. These features structure and guide the documentation rather than the coordination of activities. However, nurses have developed ways to read across the problem-oriented structure to check up on patient cases in depth or on the latest activities related to the patient. What is more, the patient-list works to alleviate problems of overview and topicality in the nursing notes, as the nurses put important topics and interventions on the list, and use a printed version of it to structure their workday and capture keywords as a scratch pad.

Second, nurses consult more often the progress notes as part of their daily updating routines and feel better informed about the medical framing of patient cases, which they monitor, comment, and align their work to. The medical agenda is considered the most important one. Nurses prioritise the content of the patient-list and, hence, their own tasks according to this agenda. Also, nursing notes have become more oriented toward the patient's medical problems as the new format invites a more focused and semantically unambiguous content, and the nurses are inclined to reading the progress notes. Simultaneously, nursing notes have also become less connected to the patient as a person. Previously, many Kardex were kept as open Kardex placed on the patient's bed table, and sometimes written together with the patient. Now, the information work of nurses is primarily taking place backstage in the office. Although this development conflicts with the explicit nursing-professional aim of involving the patient in his or her own case by making the record easy

to understand and by keeping open files, it has not been explicitly discussed among the nurses.

Third, oral reporting has been downplayed as a coordination device between shifts. A nurse from the previous shift stays 15 minutes into the next as usual. However, she is increasingly spending this time on "entering the final notes." Often, the new shift of nurses simply skims the printed patient-list, decide who takes which patients, and go straight to browsing the patients' EPR. They read the electronic record individually or in pairs, and collective discussions or meetings are rare (see also Lundberg (1999)). Thus, in the overlap of shifts, nurses tend to work at the computers rather than talk to each other. During the duty coordination is also increasingly managed by writing in the EPR-system. Communication of hunches about the patient or supplementary information, hard to squeeze into the format of the EPR-documents, is left to informal encounters.

With the computerization of nursing notes, nursing and the nurse community seem to undergo a subtle yet potentially radical development. Nurses become at one and the same time more individualized and more familiar with and co-constitutive of the medical agenda. Occasions for discussing nursing as a distinct discipline and for collective sparring are reduced. Thus, in some ways the boundaries between nursing and medicine seem to dissolve, or rather: nursing is enacted as watchdog and practical enabler of the medical universe rather than as ombudsman of the patients advocating for and enacting other concerns such as ethical or psychosocial.

4.3 The Distribution of Test Results

Test results are central to practices in the medical ward. Tests of blood, urine, and tissue are routinely ordered and performed, and X-ray or ultrasound pictures are often taken to help substantiate the isolation and diagnosis of the patient's problem. The test results are decisive for the patient's further trajectory in the hospital. Depending on the outcome of the test (i.e. normal or abnormal conditions) the patient is classified as an acute or a routine case, a case of certainty or of qualified uncertainty, each having implication for the organisational mobilization of actors and resources.

Previously, test results[4] arrived by mail to the ward according to the intersection of two temporalities: the production cycles of the laboratories and X-ray departments, and the rhythm of the mail-system. In effect, test results arrived usually around three o'clock in the secretary's in-box. A nurse would then sort the results into two piles—one for abnormal and another for normal results—and she would show the abnormal ones to the physician on duty,

when he came to go the afternoon round. In this way, the arrival of test results structured the afternoon work for secretaries, nurses, and physicians, who played the roles of receiver, sorter, and interpreter respectively. Now, test results flow directly into both the patients' folders in the EPR-system, and the result-list of all patients hospitalised, which is to the advantage of the staff that does not have to go over all electronic patient records to check for new results, but only needs to check the result-list. In principle, this altered distribution channel of test results should speed up the reading of test results and make them instantly available for all users of the EPR-system. However, what happens is that tests now enter clinical work in a more random manner. This has to do with the emergence of new tasks and the way in which these are defined and distributed among the staff.

New tasks have emerged in addition to the old ones. The test result-list must, for example, be monitored and kept up-to-date, implying that a result must be deleted when a physician has read it. Yet there have been no formal decisions or discussions about who is responsible for this task. Instead, workloads and responsibilities are negotiated *ad hoc* among the staff that adopts different strategies such as negligence, depreciation, and containment of the new tasks. Many nurses and secretaries continue, for instance, their role as sorters of test results by informing the physicians verbally about abnormal results on the result-list, and some physicians wait for this information from the nurses. In this way, many staff members seek to enact the traditional division of work among the occupational groups.

Yet despite attempts to maintain old fields of responsibility and staff hierarchy, the electronic distribution of test results is challenging deep-seated routines, especially the traditional rhythms of work of physicians and nurses. Previously, the rhythm of the laboratory, the internal mail system, and the watch divided the tasks of physicians and nurses into two big chunks: before and after the arrival of test results at three o'clock. Combined these three actants formed a time reckoning system (Clark 1985). Now results can pop up any minute and some physicians find it hard to structure the day and prioritise time (e.g. should they check frequently and react immediately on abnormal results, or should they check on fixed hours and react on results in turn?). Also nurses find themselves in a dilemma: should they still make themselves available for discussions of test results and patients with the physician around three o'clock, or should they rely on the physician to contact them if necessary? These dilemmas have not been confronted. Instead the staff has organized the working day according to individual time reckoning systems—thereby producing inappropriate organisational temporalities giving rise to other dilem-

mas and conflicts over how test results should flow into medical practice and how to spend time.

Also, transforming a digital test result into an actant in clinical work involves many phases: the result must be noticed (which depends on checking routines and on constantly tidying-up the information infrastructure in order to create overview); and the result must be singled out as a topic on the organisational agenda (which entails that it is interpreted, transformed to a medical intervention, and communicated to other organisational actors). This combined with the new kinds of dilemmas and vague fields of responsibility has given rise to new potential errors. Although computerization of test results should prevent test results from disappearing (e.g., being misplaced) quite a few results are still not noticed despite being registered twice in the electronic infrastructure. Test results can still hide in the daily businesses of the ward. Or more precisely: grave results now seem to flow faster into the organisational attention, whereas more undramatic results risk being unnoticed for a longer time.

4.4 The Medication Process

Medicine plays a crucial role for the diagnosing and treatment of patients in a medical ward—as the very name suggests. A patient is often taking several drugs at the time of hospitalisation and is usually discharged with additional or altered dosages of medicine. Giving medicine to a patient is not a straightforward task, but a long and complicated process: the drug must be prescribed in response to a patient's medical problem, and it must be measured, administered, ingested, evaluated and adjusted. Each of these steps entails keeping accounts in terms of progress notes, medicine cards, stock lists, etc., in order to ensure coherence. More precisely, medication is successful when the patient's problem is relieved by a medical prescription, which is measured in the right quantity by the nurse, administered to the patient, swallowed by the patient, and actually works to cure or alleviate the disease. Medication errors occur when gaps or mistranslations happen in this distributed, collective work.

Before EPR, the many steps in the medication process implied some sort of risk that the prescription developed from the original shape and the patient would end up getting a wrong drug, a wrong dosage of drug, or never having any drug. The medical prescription could, for example, develop from the moment it was communicated verbally to the nurse to the moment it was dictated as a progress note that the secretary would transcribe. And it could develop from the moment of dictation to the moment it was transcribed as a progress note, and then again when copied in hand writing into Kardex and

into the medicine card. Drug information was kept in three different documents, which made it hard to get an overview of the patient's medicine. Moreover, there was often no time to do the work necessary for obtaining this overview, or it was done as invisible work. In effect errors could survive for a long time. With EPR, the medication process has changed on a few dimensions for the purpose of eliminating certain notorious sources of error. Prescription must no longer be transcribed from oral to written and once again to various documents. Physicians are now required to enter all prescriptions directly into the medicine scheme of the EPR-system. From here data can be printed either as a medicine card to fit the pillbox or as a treatment card for the staff to measure quantities of liquid medicine stored in the depot. However, in practice the number of steps involved in the medication trajectory has not been reduced. Furthermore, each step still entails some sort of risk. Let me give three examples.

First, since the progress note is the binding document in legal matters, prescribed medicine must to be recorded here too. And, unlike the prescriptions, the physicians still *dictate* the progress notes which the secretary then transcribes into the EPR-system. Thus there is now double account of medicine. This bifurcation of the medicine trajectory introduces problems of inconsistency between documents, because the physician often prescribes many types of drugs over some hours and then forgets to sum up properly in the progress notes or update the medicine scheme (see Mikkelsen & Aasly (2001) for a related finding).

Second, the process of entering medicine into the medicine scheme is now vulnerable to a new kind of error, since the way in which a dosage is entered in the medicine scheme determines how it will be printed: on a perforated card for pillboxes or on regular paper for the ring binder from which liquid medicine is measured. Even a small typing error in the dosage for the pillbox means that though the drug enters the medicine scheme it is printed on paper for the ring binder. Thus, although some copying-errors are eliminated (mishearing, miswriting, and misreading the original medical answer when translating the oral statement into a type- or handwritten one) a new type of copying-error has emerged. Moreover, such errors have become even harder to detect, since patients' now have less access to the various documents about their medicine and thus less possibilities of playing an active role in comparing documents and producing an overview of their medicine.

Finally, the process of selecting a drug when making a prescription is in some respects more risky now. When the physician enters the prescription, he is guided by a dialog box, which for instance demands that he chooses the drug from a Medicine Database. However, this database covers only the trade

names of drugs and not the generic names. And when a prescription holds only the trade name of a drug it gets harder for nurses to substitute it with another, if the specific medical product is out of stock. Then the patient might end up getting a wrong substitution or no drug at all. Ultimately, this means that the logic of product assortment comes to prevail at the expense of the logic of treatment, and yet another sort of copying-error becomes likely.

To reduce these new risks the nurses have initiated a range of countermoves. When time allows, the nurses monitor the physicians' prescriptions of drugs in the progress notes and compare these with the medicine scheme. They also write nursing notes to support the monitoring of the medication process, and encourage the physicians to employ the nursing notes as containers of reliable facts. Thus, it is still hard and laborious to make data trustworthy and to generate an overview of the patient's medicine—it takes much articulation work to use Suchman's expression (Suchman 1996), which is not part of the formal description of the staff's tasks.

The new medication process casts the professional groups in slightly different and paradoxical roles. The physician now enacts the role of the privileged enunciator of the medical answer in that the EPR-system requires his password for entering data into the medicine scheme. Yet this privilege is confined, since the EPR-system only accepts his medical answer if defined by various categories and framed as the sales name of a drug. On the other hand, nothing forces the physician to actually inscribe the medical answer in the EPR-system. Thus, the physician is simultaneously afforded a privileged, regulated and voluntary position, which some physicians experience as somewhat unattractive, since to them the combination of responsibility, discipline, and typing moves the role towards that of the secretary, which "takes time from proper physician tasks".

The nurses are now assigned a role that is both more peripheral and more strongly integrated in the medication trajectory compared to earlier. On the one hand, nurses should now only focus on materializing the medical answer (printing medicine cards and measuring pills). Yet having easy access to the EPR-system, the nurses are simultaneously in a position to become highly informed witnesses of the medication. The nurses utilize this to cast themselves as agents more centrally involved in the production of coherence in the medication trajectory and in the medical decision-making: they become watchdogs of the coherency of the medication process and thus medical protagonists. But thereby nurses confirm their traditional role as those doing the, often invisible, articulation work, which might not be performed at all (Strauss et al. 1997; Hughes 1971). Thus nurses find themselves in a role,

which officially is now less important, but which in practice is even more crucial for the framing and coherence of medical work.

5 Discussion

With the introduction of EPR in the medical ward, the daily works and professional roles have changed. Having described the subtle transformation of four kinds of work activities it is clear that the changes are not easily measured and summed up. It is not obvious whether the healthcare is now better or more efficient. Neither is it obvious whether effects stem from EPR or from the staffs' behaviour. When following the socio-material rearrangement of medical practice we find improvements as well as the opposite, but, very important, we also find that old capabilities have been replaced with new ones, and that new dilemmas have taken the place of old ones. Thus, we do not find a better, but a *reconfigured* healthcare with a new distribution of actions and effects.

I will point to three dimensions of medical practice, which in effect of the introduction of EPR have been redistributed: (1) work tasks, (2) organisational attention, and (3) risks. Before I address each of these, let me summarise the empirical findings regarding the three dimensions in table 1.

5.1 The Redistribution of Work and Responsibilities

Public expectations hold that EPR will improve intra-organisational efficiency by increased exchange of information and cooperation among staff, and thus render certain work procedures superfluous and others more streamlined. Also the research literature posits that EPR may come to support and coordinate work practices. However, the descriptions of changes in four medical activities show that these expectations are, at best, imprecise. First of all, although some work tasks have disappeared, others have emerged (e.g., secretaries must no longer sort incoming test results, but must tidy up the Edifact-list, and nurses must no longer copy prescriptions in hand, but must print them on the proper type of paper). Some of these new tasks have been officially recognized and delegated to a professional group, whereas other tasks are left to be done as invisible work by conscientious staff members. Thus, it is not obvious that work procedures all in all have become more efficient. Second, this points to the fact that workloads are not equally distributed among staff, and that this inequality has given rise to various strategic countermoves, which blurs the

Redistribution of	*Authoring and reading of progress notes*	*Nurses' updating and reporting routines*	*Distribution of test result*	*Medication process*
Work and responsibility	Physicians become their own secretaries and editors, and interfere more with colleagues' cases. Nurses become active readers and commentators of physicians' work.	Nurses spend more time entering and reading notes. Nurses spend less time having oral report and collective discussions. Responsibility for single patients rather than for the group of patients.	Physicians are now formally responsible for checking and sorting results. Nurses and secretaries continue to check and sort results informally. Dilemmas arise for all staff regarding the structuring of the workday and the use of time.	Physicians must now enter and not dictate prescriptions. Secretaries and nurse must no longer copy prescription. Production of overview still takes much extra work, which is done informally by nurses.
Organisational attention	Stronger focus on medical aspects of patient case.	Stronger focus on documentation. Weaker focus on patient involvement. Stronger focus on medical aspects of patient case. Weaker attention to ethical and psycho-social aspects of patient case.	Stronger attention to abnormal results. Weaker attention to normal results.	Sales name logic of medicine comes to dominate a generic logic.
Risks	Risk of idiosyncratic framing of patient cases is replaced with risk of illegitimate readers.	The medical agenda is more negotiated. Other aspects of patient case downplayed.	No test results disappear. Test results may still be overseen.	New copying-errors replace old ones. Risk of inconsistent medical data due to double bookkeeping. Still hard to obtain an overview of prescriptions

Table 1. An overview of the way work, organisational focus, and risks have become redistributed in four kinds of work activities in the medical ward after the introduction of EPR

organisational distribution of rights and duties, which seems to complicate cooperation among the staff. Some nurses do, for instance, use their access to physician notes to monitor and encroach on the physicians' work, whereas many physicians' try to safeguard their professional territory by focusing on "core medical activities" (e.g., to which nursing notes do not belong). Third, rather than feeling supported in their work practice, members of the professional groups feel their professional identity challenged. Old skills and competencies have become irrelevant and new ones needed. The staff recognizes the new opportunities, but they also point to things that they are no longer able to do. Thus, the fact that responsibilities and competencies are yet to be determined cannot simply be viewed as a question of learning or organisational development. Many work tasks are neither collectively acknowledged, nor clearly demarcated, and the staff is often caught at the horns of dilemmas as to the use of resources and coordination with others.

5.2 The Redistribution of Organisational Attention

Related to the assumption of increased exchange of information and better coordination, it is expected that EPR will facilitate stronger coordination of healthcare across professional territories and organisational units, and thus higher quality in healthcare. Yet analysing the empirical findings we must draw a subtler conclusion. There are clear examples of staff groups increasingly sharing knowledge about patients and of increased documentation and coordination of patient cases (e.g., nurses regularly read physician notes and align their work to the medical agenda; there are more informal monitoring and negotiations of medical aspects of the patient cases across professional boundaries and seniority). However, there are also examples of weaker focus on other kinds of knowledge (e.g., less documentation of psycho-social aspects in nursing notes, and less involvement of the patient in the framing of the patient case). Rather than a better-coordinated healthcare, we might say that people, texts, and tools are now connected in ways that lead to *more* coordination of *fewer* aspects of the patient cases—of drugs and diagnoses, roughly speaking. The combination of more medically coloured statements in EPR and the staff's wider access to and deeper involvement in this textual universe lead to an increasingly better coordinated *medical* regime, where nurses, secretaries, and physicians are cast in the roles of monitoring, arranging, and personifying the enactment of the patient as a medical case.

5.3 The Redistribution of Risks

EPR are assumed to reduce the notorious risks of errors in patient treatment, because data is systematically accumulated and coordinated, and clinical decision-making can be made on a correct and sufficiently informed foundation. However, despite the fact that EPR occasion tighter cooperation of staff, texts, and tools around medical aspect of the patient case, medical practice still implies risks for the patient (e.g., medical information may be inconsistent across documents, prescriptions may never be measured, illegitimate readers may pry into patient cases, test results may be overseen). It could be argued that business process reengineering and better technical design could eliminate many of these risks. Yet on closer inspection risks seem not only to arise from bad technical or organisational design, but also from inherent dilemmas in the organisational network. The specific socio-material arrangement is generating some of these dilemmas. The physician, for example, faces now the dilemma between checking often and checking systematically for new test results. Others seem to be part of any information infrastructure. Thus, the problems of overview increase with the amount and granularity of information (Timmermans et al. 1998; Bowker & Star 1999). However, other dilemmas follow from the very way in which work practices are integrated and coordinated, which implies more abstract or diffuse kinds of risk.

Conventionally, errors are seen as caused by either human or technical failures, and efforts are typically directed towards enjoining the staff scrupulous task performance and adding fail-guarding mechanisms to the technology. However, many current sociotechnical systems are so complex and intricately coupled that it is hard to locate the error cause(s), and furthermore the very efforts of making the systems safe can lead to grave and incomprehensible accidents (Perrow 1984; Law 2000). Thus, Perrow argues that as organisational systems grow progressively more complicated and tightly coupled, the likelihood increases that accidents will be of greater seriousness when they happen. The hospital is usually conceptualised as a complex, but loosely coupled organisational structure (cf. Mintzberg 1979; Perrow 1984). The functional differentiation of work is high, but due to the unpredictable character of the subject matter (patients come with diverse and often unclear symptoms) and some uncertainty regarding the proper ways to treat patients, it is not possible to fully standardize the flow of work within and across units. A certain amount of slack and redundancy is required to allow for situational reorganisations and some degree of discretion. However, with EPR work practices in the medical ward seem to be more tightly coupled and organisational slack reduced. The stronger coordination and exchange of medical information pro-

duces a uniform organisational understanding of the patient case, which diminishes the risk of the staff not knowing exactly what the patient suffers from. Yet the tighter integration increases the risk is that small failures are allowed to travel fast and combine in unpredictable and incomprehensible ways. This risk is heightened, since the patients have become side-tracked as active constituents of their case files. As these files multiply in hundreds of screen versions outside the patients' contexts of attention, minor co-occurring errors are more likely to have serious consequences. For example a patient's psychiatric diagnosis and the diagnosis of diabetes become known by all staff; another patient's blood test not indicating anything abnormal is mislabelled and results sent to the first patient's electronic record, whose medicine is therefore not properly adjusted, why he does not get the necessary amount of insulin and suddenly develops a serious attack of *ketoacidosis*[5], because the staff interprets the patient's fatigue and frequent breathing as related to the psychiatric diagnosis, since the blood test is normal. Therefore, I wish to argue that with EPR, medical practice becomes vulnerable to a type of risks, which cannot be reduced to isolated inexpediencies, but which arises from exactly the virtues that EPR are expected to promote, and which to some degree are promoted, as I have shown: increased integration of the medical aspects of patient trajectories across professional and organisational boundaries.

5.4 Implications of a Theory of Distribution

I have showed how the introduction of EPR in a medical ward has not resulted in better or more efficient medical practice, but in a *different* kind of medical practice with a new distribution of work, responsibilities, capabilities, attention and risks. I have also argued that this finding cannot be fully explained by lack of organisational development or by poor design of the EPR, but is a matter of deep organisational dilemmas, which are altered or continued with the introduction of a new technology. These organisational dilemmas prompt actors to make trade-offs and compromises, which result in a certain distribution of energy and resources. And from this recursive distribution, certain patterns of organisational activity emerge. We might thus say that by introducing ICT in an organisation, relations and dilemmas become reshuffled in a way that redistributes organisational characteristics and capabilities. The relationship between ICT and organisational change must, therefore, be conceptualised on the basis of a theory of distribution rather than on a theory of improvement.

This has implications for the way in which we can think of design and implementation of EPR—and ICT in general. Before addressing these, let me

recapitulate predominant theoretical views on design and implementation of ICT. In both medical informatics and CSCW the relationship between technology and organisation is viewed as a question of fit between the two elements in order to improve overall performance. Yet the two traditions differ in the way in which elements should fit. In medical informatics, design is seen as a matter of construing a functional technology, and implementation as a matter of gearing the organisation to use the technology optimally. In contrast, the CSCW-tradition argues that it is primarily the technology, which has to fit work practices. Here, design is seen as the process whereby a supportive technology is build, and implementation as the process of fine-tuning the relationship between technology and user. Research within the STS-tradition has criticized both schools for operating with essentialist definitions and explanations of technology, organisation, user, and improvements, because these entities are fundamentally enmeshed and co-constitutive in unpredictable ways, which makes it hard to pre-plan and evaluate effects. Viewed through these lenses, design and implementation are open-ended, experimental and conflict-ridden negotiation processes. Yet when it comes to assessing the larger effects of EPR on work practices, the STS-literature is empirically weak and can, as I shall argue, be theoretically developed.

My own study started from the methodological principles of this latter tradition, and exploring the way in which an EPR-system participates in daily work practices in a medical ward has shed some light on this. It has thus substantiated basic tenets of STS-studies: that effects arise from the intricate relations among heterogeneous actors in a fundamentally conflict-ridden and open-ended process of no universal success criteria. The study has, however, deepened these theoretical points by showing that when ICT is introduced in an organisation, we must be prepared to find things not simply changed in unforeseen ways but *redistributed*. Hereby, a constructionist view on technology and organisation comes to imply more than the proposition that nothing is pre-given and emerges as effects of network activities. It come also to imply that the emergence of effects is to be understood as a process, in which other effects concomitantly disintegrate: when new capabilities arise, so do new risks; when new competencies are produced, so are new incompetencies; and when a new order is established, so is also a new disorder.

This calls for a more careful use of normative claims such as improvement, optimal and smart when discussing ICT-projects. Words like these are persuasive statements, which easily lure us to forget about the price that we inevitably must pay for any kind of progress. In order to remind ourselves of this, we may use the findings from my study to ask the following questions to any ICT-project throughout the phases of design, implementation, and daily operation:

- *The redistribution of work:* Who will be relieved? Who must work harder?
- *The redistribution of attention:* What is brought into focus with what effect? What kind of blindness is made with what effect?
- *The redistribution of risks:* How is risks reduced for whom? How is risks heightened for whom?

Of course, it is hard to find complete answers to such questions. However, the point is not to work out a spreadsheet of gains and losses, but to become aware of the deeply paradoxical nature of technology and organisational change. By thinking in terms of distribution rather than improvement, we may open our eyes to whole new and extremely important, *political* aspects of EPR in healthcare, e.g., a healthcare in which drugs and diagnoses are brought to the foreground at the expense of more patient involvement. Moreover, we may better understand that when unexpected effects occur it is not simply due to "stupid design," "poor modelling," or "too little user-focus," but also to inherent dilemmas regarding the organisation of matter, which force us to prioritise, and which, therefore, make design an inherently political activity. And when ICT is not smoothly implemented it is not simply a matter of "resistance to change," "lacking skills," or "bad process," but also of underestimating the scope and degree to which established working orders are shaken and political discussions concerning values, resources, rights and duties activated.

We should not be paralysed by the unpredictable and political nature of organisational change, but keep on experimenting, trying out new things and having aspirations. Yet we should have a keen eye to unexpected consequences and emerging dilemmas, and we need more research into the way in which we can design, implement and evaluate ICT on the basis of a theory of distribution. To reflect on such dimensions is not to delay the process of introducing EPR into hospitals or to capitulate to a messy healthcare, but to open new windows of thinking and acting.

Notes

1. PACS are technologies that work to store, process, distribute, and archive digital pictures such as X-ray pictures. In contrast EPR encompasses more diverse kinds of data (writings, pictures, animations, graphics), involve a broader group of professionals, and more interaction between users through writing. However, despite this difference in complexity and comprehension it seams reasonable to learn from the research into PACS.

2. This term refers to the type of physician duty, which takes care of the initial phase of the patient trajectory. It includes thoroughly examination of the body, querying about the circumstances of hospitalisations, ordination of basic tests and the reporting of all this in the record. Mainly manned with younger residents on training.
3. This term refers to the type of physician watch, which is responsible for all medical decisions in the ward. Manned with older, experienced physicians.
4. Test results can be divided into three categories: "urgent", "pushed" and "regular" tests. Here, I will only deal with the regular tests, because the introduction of EPR most clearly alters the organizational network around these.
5. *Ketoacidosis* is a sudden and life-threatening condition that can arise in 12 hours if a patient with insulin-dependent diabetes does not get the necessary amount of insulin.

References

Andersen, S. K, Nøhr, C., Vingtoft, S., Bernstein, K., Rasmussen, M. B. "A Comparative Study of EPR Projects in Denmark", in *Conference Proceedings for Medical Informatics in Europe 2002,* G. Surján, R. Engelbrecht, and P. McNair (eds.), IOS Press, Amsterdam, 2002, pp. 226-231.

Akrich, M. "The De-Scription of Technical Objects," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*, W. Bijker, and J. Law (eds.), MIT Press, Cambridge, MA, 1992, pp. 205-224.

Atkinson, C., and Peel, V. "Growing, Not Building, the Electronic Patient Record System," *Methods of Information in Medicine* (37), 1998, pp. 206-310.

Berg, M. "Of Forms, Containers, and the Electronic Medical Record: Some Tools for a Sociology of the Formal," *Science, Technology, and Human Values* (22:4), 1997, pp. 403-433.

Berg, M., and Bowker, G. "The Multiple Bodies of the Medical Record: Toward a Sociology of an Artifact," *The Sociological Quarterly* (38:3), 1997, pp. 513-537.

Berg, M. "Accumulating and Co-ordinating: Occasions for Information Technologies in Medical Work," *Computer Supported Co-operative Work* (8:4), 1999, pp. 373-401.

Berg, M. "Implementing Information Systems in Healthcare Organizations: Myths and Challenges," *International Journal of Medical Informatics* (64:2&3), 2001, pp.143-156.

Berg, M., and Toussaint, P. "The Mantra of Modelling and the Forgotten Powers of Paper: A Sociotechnical View on the Development of Process-Oriented ICT in Healthcare," *International Journal of Medical Informatics* (69:2&3), 2003, pp. 223-234.

Bowker, G., and Star, S. L. *Sorting Things Out: Classification and its Consequences.* MIT Press, Cambridge, MA, 1999.

Callon, M. "Some Elements of a Sociology of Translation: Domestication of the Scallops and the Fisherman of St. Brieuc Bay," in *Power, Action and Belief: A New Sociology of Knowledge*, J. Law (ed.), Routledge and Kegan Paul, 1986, pp. 196-233.

Clark, P. "A Review of the Theories of Time and Structure for Organizational Sociology," *Research in the Sociology of Organizations* (4), 1985, pp. 35-79.

Elberg, P. "Electronic Patient Records and Innovation in Healthcare Services," *International Journal of Medical Informatics*, (64:2&3) 2001, pp.201-205.

Ellingsen, G. and Monteiro, E. "A Patchwork Planet – Integration and Cooperation in Hospitals," *Computer Supported Cooperative Work* (12:1), 2003a, pp.71-95.

Ellingsen, G. and Monteiro, E. "Big is Beautiful: Electronic Patient Records in Norway 1980-2000," *Methods of Information in Medicine*, (42:4), 2003b, pp. 366-370.

Ellingsen, G. and Monteiro, E. "Mechanisms for Producing a Working Knowledge: Enacting, Orchestrating, and Organizing," *Information and Organization*, (13:3), 2003c, pp. 203-229.

Grimson, J. "Delivering the Electronic Healthcare Record for the 21st Century," *International Journal of Medical Informatics* (64:2&3), 2001, pp.111-127.

Hannan, T. "Variation in Health Care—The Roles of the Electronic Medical Record," *International Journal of Medical Informatics* (54:2), 1999, pp.127-136.

Hanseth, O., and Monteiro, E. "Changing Irreversible Networks: Institutionalisation and Infrastructure," in *Proceedings from ECIS*, W. R. J Bates (ed.), Aix-en-Provence, France, 1998.

Hartswood, M., Procter, R, Rouncefield, M., and Slack, R. "Making a Case in Medical Work: Implications for the Electronic Medical Record," *Computer Supported Cooperative Work* (12:3), 2003, pp.241-266.

Haux, R., Ammenwerth, E., Herzog, W. and Knaup, P. "Health Care in the Information Society. A Prognosis for the Year 2013," *International Journal of Medical Informatics* (66:1), 2002, pp.3-21.

Heath, C., and Luff, P. *Technology in Action*, Cambridge University Press, UK, 2000.

Hughes, E. *The Sociological Eye*, Aldine-Atherton, Chicago, 1971.

Hutchins, E. *Cognition in the Wild,* MIT Press, Cambridge, MA, 1995.

Iakovidis, I. "Towards Personal Health Record: Current Situation, Obstacles and Trends in Implementation of Electronic Healthcare Record in Europe," *International Journal of Medical Informatics* (52:1-3), 1998, pp.105-115.

Jensen, C. B. and Winthereik, B. "Political and Moralising Moments: On Visions of IT in Danish Healthcare," *Information Technology & People* (15:3), 2002, pp. 227-241.

Jones, M. "Computers Can Land People on Mars, Why Can't They Get Them to Work in a Hospital? – Implementation of an Electronic Patient Record System in a UK Hospital," *Methods of Information in Medicine* (42:4), 2003, pp. 410-415.

Kay, S. "Health Informatics: Challenges to Progress," *Methods of Information In Medicine* (38:4&5), 1999, pp.225-228.

Latour, B. "Technology is Society Made Durable," in *A Sociology of Monsters? Essays on Power, Technology and Domination,* J. Law (ed.), Routledge and Kegan Paul, London, 1991, pp. 103-130.

Latour, B. "Where Are the Missing Masses? A Sociology of a Few Mundane Artifacts," in *Shaping Technology/Building Society: Studies in Sociotechnical Change*, W. Bijker, and J. Law (eds.), MIT Press, Cambridge, MA, 1992, pp. 225-258.

Latour, B. *Pandora's Hope – Essays on the Reality of Science Studies,* Harvard University Press, Cambridge, MA, 1999.

Law, J. *Organizing Modernity,* Blackwell, Oxford, 1994.

Law, J. "Ladbroke Grove, Or How to Think about Failing Systems," Center for Science Studies and the Department of Sociology, Lancaster University. http://www.comp.lancaster.ac.uk/sociology/soc055jl, 2000.

Lundberg, N., and Tellioglu, H. "Understanding Complex Coordination Processes in Health Care," *Scandinavian Journal of Information Systems* (11:1), 1999, pp.157-181.

Lundberg, N. "Impacts of PACS on Radiological Work," in *Proceedings of the International ACM SIGGROUP Conference in Supporting Group Work*, ACM Press, New York, 1999, pp. 169-178.

Lærum, H., Ellingsen, G. and Faxvaag, A. "Doctors' Use of Electronic Medical Records Systems in Hospitals: Cross Sectional Survey," *British Medical Journal* (323), 2001, pp. 1344-1348.

McDonald, C. J. "The Barriers to Electronic Medical Record Systems and How to Overcome Them," *Journal of the American Medical Informatics Association* (4:3), 1997, pp. 213–221.

Mikkelsen, G. and Aasly, J. "Concordance of Information in Parallel Electronic and Paper Based Patient Records," *International Journal of Medical Informatics* (63:3), 2001, pp.123-131.

Mintzberg, H. *Structuring of Organizations: A Synthesis of Research,* Prentice-Hall, Englewood Cliffs, NJ, 1979.

Müller, M., Bürkle, T., Irps, S., Roeder, N. and Prokosh, H. "The Diagnosis Related Group Enhanced Electronic Medical Record," *International Journal of Medical Informatics* (70:2&3), 2003, pp.221-228.

Nøhr, C., Kristensen, M., Andersen, S. K., Vingtoft, S., Lippert, S., Bernstein, K., and Bruun-Rasmussen, M. "Shared Experience in 13 Local Danish EPR Projects: The Danish EPR Observatory," in *Proceedings of the 10th World Congress of Medical Informatics*, V. L. Patel, R. Rogers, R. and Haux (eds.), IOS Press, Amsterdam, 2001, pp. 670-674.

Perrow, C. *Normal Accidents: Living with High Risk Technologies,* Basic Books, New York, 1984.

Safran, C, Sands, D. and Rind, D. "Online Medical Records: a Decade of Experience," *Methods of Information in Medicine* (38:4&5), 1999, pp. 308-312.

Schneider, K,. and Wagner, I. "Constructing the 'Dossier Représentatif', Computer-Based Information Sharing in French Hospitals," *Computer Supported Cooperative Work* (1), 1993, pp. 229-253.

Strauss, A. *Qualitative Analysis for Social Scientists,* Cambridge University Press, Cambridge, MA, 1987.

Strauss, A., Fagerhaugh, S., Suczek, B. and Wiener, C. *Social Organization of Medical Work,* Transaction, New Brunswick, 1997.

Sujansky, W. "The Benefits and Challenges of an Electronic Medical Record: Much More that a 'Word-Processed Patient Chart'," *The Western Journal of Medicine* (169:3), 1998, pp. 176-183.

Suchman, L. "Supporting Articulation Work," in *Computerization and Controversy: Value Conflicts and Social Choice,* R. Kling (ed.), Academic Press, San Diego, 1996.

Svenningsen, S. "Electronic Patient Records and Medical Practice: Reorganization of Roles, Responsibilities, and Risks," PhD-Series 10.2003, Samfundslitteratur, Copenhagen, 2003.

Timmermans, S., Bowker, G., and Star, S. L. "The Architecture of Difference: Visibility, Control, and Comparability in Building a Nursing Intervention Classification," in *Difference in Medicine – Unraveling Practices, Techniques, and Bodies,* M. Berg, and A. Mol (eds.), Duke University Press, Durham, 1998, pp. 202-225.

Ueckert, F., Goerz, M., Ataian, M., Tessmann, S. and Prokosh, H. "Empowerment of Patients and Communication With Healthcare Professionals Through an Electronic Health Record," *International Journal of Medical Informatics* (70:2&3), 2003, pp. 99-108.

Weed, L. *Knowledge Coupling: New Premises and New Tools for Medical Care and Education,* Springer Verlag, New York, 1991.

Winthereik, B. "We Fill in Our Working Understanding: On Codes, Classifications and the Production of Accurate Data," *Methods of Information in Medicine* (42:4), 2003, pp. 489-495.

Zuiderent, T. "Blurring the Center: On the Politics of Ethnography," *Scandinavian Journal of Information Systems* (14:2), 2002, pp.59-78.