

Common Information Spaces along the illness trajectories of chronic patients

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Abstract The notion of Common Information Spaces (CIS) is extensively used as a framework to analyse cooperative work. Drawing on recent contributions to the discourse on CIS, this paper develops a perspective on how information is shared in heterogeneous contexts. We study the introduction of an electronic nursing plan in the psychogeriatric ward at the University Hospital of North Norway. The plan was expected to improve information sharing among the healthcare practitioners and in that sense contribute to their CIS. However, although the nursing plan was regularly updated, it was less used *in practice* than initially expected. We suggest that this can be ascribed to the temporal and evolving character of both medical information and work. Drawing on the notion of trajectories, we elaborate on these findings and develop a perspective on CIS, emphasising its situated, temporal and negotiated character.

Introduction

The notion of Common Information Spaces (CIS) is extensively used within the CSCW field as a framework for analysing cooperative work. A CIS denotes the context in which information is shared between actors whose work practices interleave. With a particular focus on the interrelationship between actors, artefacts, information and the situations in which these meet, it aims at refining our understanding of how artefacts support coordination and articulation work in cooperative settings (Schmidt and Bannon, 1992; Bannon and Bødker, 1997; Randall, 2000; Bossen, 2002).

CIS comes in many forms and is used in various contexts (for example, see Bannon and Bødker, 1997). As illustrated by Bossen (2002), it is of particular interest as a framework to analyse problem-solving activities in heterogeneous work settings. These typically involve places and situations with a high degree of inter-communication and “where the meanings of the shared objects are debated and resolved” (Schmidt and Bannon, 1992, p.27).

In this paper, we explore the notion of CIS by drawing on empirical data from the healthcare context. Healthcare services today typically are profoundly fragmented across technical, organisational and professional boundaries, thus resembling the heterogeneity described above. Knowledge about treatment and care is increasingly dispersed among many people and many technologies, and single doctor-patient relationships are gradually being replaced by a shared-care approach in which the individual patient’s healthcare is handled by a team of professionals, each specialising in one particular aspect of care (Grimson et al., 2000). Throughout the illness trajectory, patients today face individual healthcare practitioners and/or organisations whose knowledge of each other’s activities is limited. Accordingly, expressions such as shared care, integrated care and continuity of care are commonly used to denote more general ambitions of creating coherent and effective health care services for patients across disciplinary and institutional boundaries (Winthereik and Vikkelsø, 2005).

Fundamental to the ongoing efforts of overcoming institutional and interdisciplinary boundaries are infrastructural arrangements such as electronic patient records (EPRs), standards, procedures, classification schemes and the like (Grimson et al., 2000). These form the link that is assumed to enhance information sharing and coordination of work so that patients are given a coherent service where every professional perspective is accounted for. The assembly of infrastructural arrangements and the various work practices they entrench delineate what is denoted as CIS in the CSCW literature.

Empirically, we have studied the implementation of the nursing care plan at the psychogeriatric ward in the University Hospital of North Norway (UNN). The ward serves elderly patients who suffer from a combination of chronic and psychiatric conditions. Work at the ward thus entails extensive cooperation across professional boundaries. Aligned with contemporary efforts to promote the nursing profession in the health sector, the nursing plan was expected to improve information sharing among the healthcare practitioners. This included an improved documentation practice together with enhanced predictability and a clearer overview. However, although the nursing plan was regularly updated and contained current status information about all patients, we observed that it was less used in practice than its primary users, the nurses, wanted. For example, the plan was used to a lesser degree in close cooperative settings such as during admission of patients, in nursing handover conferences and in interdisciplinary meetings.

We suggest that this can be ascribed to the temporal and evolving character of both medical information and work. Drawing on the notion of trajectories, we elaborate on these findings. In particular, we pay attention to how the nursing plans were integrated into the work practice. Our main objective is to contribute to a conceptualisation of CIS (see Reddy et al., 2001; Bossen, 2002; Rolland et al., 2006) by providing a temporal dimension to *how* information is made common in heterogeneous work practices. Analytically, we draw on the notion of trajectories (Strauss et al., 1985; Timmermans and Berg, 1997) in which we explore how work is accomplished along the trajectories of chronic patients. In this sense, trajectories “refer not only to the physiological unfolding of a patient’s disease but the total *organization of work* done over that course, plus the *impact* on those involved with that work and its organization” (Strauss et al., 1985, p.8). We proceed along the following dimensions:

Firstly, we explore what kind of information sources and artefacts are in use in cooperative settings that cut across professional boundaries. We elaborate on the nature of CIS (manifested by the points at which the work trajectories of physicians and nurses intersect) as situated, temporal, regularly (re)negotiated and achieved in practice. The nursing plan, we argue, is only one entity in a larger information infrastructure. Its particular value is in constituting the nursing perspective on the care process, as the medical cardex does for the physicians’ perspective.

Secondly, we discuss how medical data is not fixed and self-contained, but evolves over time during the patient’s illness trajectory. To portray this evolving trajectory, the plan had to be linked with a variety of information entities and practices. We develop our argument by providing an example from the nursing handover conference, which is a setting where it is crucial to know how a patient is progressing.

Thirdly, we illustrate the unpredictable nature of the plan. We analyse the trajectory of the nursing plan and stress its uncertain and contingent character and how it eventually became an infrastructural entity that appealed to a new reality. In our case, it increasingly became entangled with managerial concerns for resource management and control.

The remainder of this paper is organised as follows. First we elaborate on the theoretical foundation for the paper. We then describe the setting for our empirical investigation and describe the method used, followed by a description of the case. Subsequently the case is analysed. In the conclusion, we consider some implications contributing to the conceptualisation of CIS.

Theory

Related work on Common Information Spaces

The notion of CIS was originally proposed by Schmidt and Bannon (1992) as a response to the, at that time, somewhat objectified perceptions of how information is shared among actors whose work activities interleave:

“Cooperative work is not facilitated simply by the provisioning of a shared database, but rather requires the active construction by the participants of a common information space where the meanings of the shared objects are debated and resolved, at least locally and temporarily” (Schmidt and Bannon 1992, p.27).

Human interaction is always mediated by representations of information. Hence our experiences and the way we perceive the world can never be replicated perfectly. Schmidt and Bannon (1992) in particular point out that information entities always have to be interpreted by human actors. By doing so, a clear distinction is made between the carrier of information and its meaning. The common information space then is said to encompass “the artifacts that are accessible to a cooperative ensemble as well as the meaning attributed to these artifacts by the actors” (Schmidt and Bannon, 1992, p.28). At the core of their argument is how information is continuously decontextualised to make it commonly available, and how it is subsequently recontextualised within the framework of its new work context (Schmidt and Bannon, 1992). In this process, the notion of articulation work is crucial as a mechanism to handle the contingent nature of cooperation and preserve the flow of work (for example, see Strauss et al. 1985; Gerson and Star 1986). A main objective in CIS, then, is to reduce the complexity in articulation work.

Bannon and Bødker (1997) refine the notion of CIS by providing an account of how information is made common. They argue that a CIS is dialectical in nature - both open and closed at the same time. “Openness” refers to the way information is always malleable and interpretatively flexible in local communities of practice. ‘Closed’ refers to the way information goes through a process of closure and becomes boundary objects (Star and Griesemer, 1989) - immutable and portable across different communities of practice. A further refinement of the CIS, they argue, needs to address the interplay between these two perspectives (Bannon and Bødker, 1997, p.87). In their refinement of the concept, they identify five domains in which the degree of closure is increasingly visible. At the one end they identify coordination centres, such as control rooms, in which the participating actors are co-present and where it is crucial that the CIS remains open and malleable. At the other end they place the web, in which information is packaged and made available to a larger, distributed audience.

The assumed idea of commonality is however problematised by Randall (2000). In demonstrating how classification scheme maintenance increasingly becomes difficult as the number and range of users increases, Randall argues that:

“... the very notion of CIS is radically underspecified. It is not possible to distinguish its putative features by reference to technology, to information or to organizational structure. At very least we might begin to recognise that the problems of classification use in CIS are likely to range along a continuum which stretches from shared, small group, work tasks to complex inter-organizational chains.” (Randall, 2000, p.17)

A more recent contribution in this respect is proposed by Bossen (2002). Based on ethnographic fieldwork within a hospital ward, Bossen delineates seven parameters that can be used to position a CIS. The parameters include the degree of distribution of work, the multiplicity of webs of significance, the level of required articulation work, the multiplicity and intensity of means of communication, the web of artefacts, the immaterial mechanisms of interaction, and the need for precision and promptness of interpretation (Bossen, 2002, p.176). Erickson and Kellogg (2003) add to this picture by describing how artefacts are socially translucent and thus make visible the various professional activities in cooperative settings.

In studying how information is incorporated into the diverse work practices of an intensive care unit, Reddy et al. (2001) contribute to our understanding of the dialectical nature of CIS. In studying how a group of healthcare practitioners made use of a shared information system, they found that the particular strength of a computer-based system was its ability to decouple information from its representation. Although the healthcare practitioners had a common focus on patient care, decoupling enabled the production of more specialised representation of information, which subsequently allowed the various professionals to work more effectively together.

Rolland et al. (2006) provide another relevant contribution. Based on a study of different CIS in a major international oil and gas company, they argue that some CIS appear as much more situated, momentary and malleable when embedded within extremely heterogeneous contexts. They claim that infrastructural arrangements for a CIS that attempts to cut across various communities of practice and heterogeneous collections of information inevitably will produce new instances of fragmentation (Rolland et al. 2006, p.499).

Nursing Care Plans as infrastructural arrangements in CIS

Nurses are commonly referred to as the ones "who weave together the many facets of the [health care] service and create order in a fast flowing and turbulent work environment" (Allen, 2004, p.279). Therefore, their associated tool, the nursing plan, is an infrastructural arrangement that will inevitably play a key role in producing CIS. Located at the very core of patient care delivery, nursing care plans are assumed to contribute to higher quality of care and better cost containment (Reed and Stanley 2003; Sexton et. al 2004). In addition, it is assumed that a nursing plan provides for appropriate treatment and continuity of care for the patient within and across institutional boundaries (Reed and Stanley 2003). As argued by Voutilainen et al (2004, p. p72):

“(…) its [the nursing plan’s] primary purpose is to ensure the individuality and continuity of care (…) When documentation is accurate, individual, pertinent and up-to-date, it promotes consistency and effective communication between nurses and the other team members involved in care.”

Similar arguments are also echoed in Norwegian policy documents (KiTH 2003, p. 18)

“(…) documentation of this work process [nursing process] is also called the care plan, it is interdisciplinary and can be used by all professions.”

Basically, a nursing plan is an overview of nurse-related diagnoses (problems) combined with relevant interventions for a patient with a chronic disorder. At the core of the nursing plan is its shared terminology. The nurses apply this terminology to describe the patients’ problem (i.e. nursing diagnoses) and link this to one or several interventions, detailing what to do in certain situations and several outcomes to enable an evaluation of what nursing care can affect. Some of the most well-known systems are that of the North American Nursing Diagnosis Association (NANDA), the Nursing Intervention Classification (NIC) and the Nursing Outcome Classification (NOC) (for example, see Gordon, 1998).

Another ‘promise’ associated with the electronic nursing plan, and a more structured documentation process, is that it is expected to replace a variety of existing dispersed information sources in the hospital. In terms of sharing information, this is considered to be a major problem, for example during handover conferences:

[The nursing handovers] however often lack formal structure and this is compounded by a lack of guidelines for the nurse giving the report. Consequently, the information presented may be irrelevant, repetitive, speculative or contained in other information sources” (Sexton, 2004, pp.37-38).

Integrating the information in the plan is implicitly assumed to enhance information sharing among the nursing practitioners. However, the literature reveals a nursing community whose actual compliance with a structured documentation process is rather low (Björvell et al., 2002; Sexton et. al 2004). Studies have indicated that “nurses have problems integrating the nursing process and care planning into their daily record-keeping” (Björvell et al., 2002, p.35). In a survey cited by Sexton et al. (2004, p.38) “nursing care plans were referred to in handover only 1% of the time and this was probably because care plans were not being updated”.

Trajectories

In hospitals, there have been many efforts in integrating heterogeneous information sources (Ellingsen and Monteiro, 2003), thus contributing to a CIS. However, work in hospitals is clearly depending on the patient case and how the patient’s illness develops. This draws attention to a temporal and evolving character of both medical information and work. Thus, adding a temporal dimension to CIS is

necessary. Therefore, we draw on the notion of trajectories (Strauss 1993; Strauss et al. 1985). Strauss describes it as follows:

“(1) the course of any experienced phenomenon as it evolves over time (an engineering project, a chronic illness, dying, a social revolution, or national problems attending mass or “uncontrollable” immigration) and (2) the actions and interactions contributing to this evolution” (Strauss 1993, pp53-54)

The lens provided by such an approach is particularly useful for explicating (i) the multiple perspectives and meanings surrounding new medical technologies and (ii) how these evolve over time. In this regard, Orlikowski and Yates (2002, p. 687) emphasise that there is “ongoing constitution of multiple temporal structures in people’s everyday practices”.

Healthcare work is shaped by the patient’s illness and how this illness is expected to develop. The term “trajectory” has been suggested to conceptualise the chain of tasks associated with the course of the illness of a patient. This concept emphasises that patients follow a trajectory that refers to a past, a present, and a possible future. As indicated above, this refers not only to the physiological unfolding of a patient’s disease but to the total organisation of work done over that course, plus the impact on those involved with that work and its organisation (Strauss et al. 1985, p.8). Reddy et al. (2006, p. 37) emphasises the temporal logic with illness trajectories by underscoring that:

A patient’s particular illness trajectory also creates a structured “timeline” of activities, events, and occurrences – a temporal trajectory.

This is illustrated by the way nurses (from a care perspective) continuously construct “histories” and “futures” when writing reports between nursing shifts (for example, see Munkvold et al. 2006).

However, the resulting patient trajectory will never be the result of consciously developed plans or a particular sequence of decisions. Rather, it is the emergent effect of the interlocking of entities doing subtasks. This, (Berg, 1997, p.138) explains, gives rise to an understanding of plans as a kind of trajectory which “is continually reset on the spot, as the outcome of the continual articulation work”. The nursing plan, for example, conceptualised as a process, is a trajectory that is constantly changed, altered, negotiated in response to changes in the surrounding nodes that constitute the heterogeneous network of planning.

Method

Research setting

The research was conducted at the University Hospital of North Norway (UNN), which has some 5000 employees, including 450 physicians and 1000 nurses. The hospital has 600 beds, of which 150 are psychiatric. The actual study took place

in the psychogeriatric ward, which is one of four wards in the Department of Special Psychiatry

The psychogeriatric ward is a closed unit. Nobody can enter or leave it without explicit permission (such as a key). The ward has 15 rooms, and treats 95 patients a year with an average length of stay of 6-8 weeks. There are 45 people working permanently here, including nurses, unskilled workers and substitutes, social workers, occupational therapists and physiotherapists. In addition, three physicians and one psychologist pay regular visits. The turnover at the ward is high, with up to 5 new unskilled workers starting each month.

Patients here are 65 or older and have usually been diagnosed with a psychiatric disorder such as dementia or anxiety. Many of them have been transferred here from high-security closed units, where they have come close to breaking doors and walls. They might thus constitute a danger both to themselves, to other patients as well as staff. The first room you come into is the day room. Typically the patients sit in this room, often with a nurse nearby. The room is usually strikingly silent. Occasionally, low whispering can be heard when nurses talk with the patients. As some patients may have severe psychoses with serious mental and behavioural disorders, the situation might change abruptly and dramatically. A patient might start to yell and upset other patients. In such situations, resources are mobilised quickly. The activities in which the staff were involved (writing, feeding, discussion, meetings, etc) are suspended and attention is focused on the agitated patient.

A set of formal regulations is important in shaping the resources needed to treat individual patients. Broadly, these differentiate between patients who have been admitted voluntarily and those who have been committed to the ward involuntarily. For example, a patient who has been committed must be treated and followed up one-to-one and is not allowed to leave the ward without being accompanied by a member of the staff.

The diagnoses mentioned above and the fact that medical treatment may have little or no effect on these disorders result in a work environment whose activities are directed towards a interdisciplinary approach to care and treatment. In this ward, environmental therapy and individual attention are considered crucial in creating a safe and stable situation for patients. Observations made by the staff are considered particularly important for the treatment that is given, for instance, in feeding situations, self-care, etc.

Research method

This study adheres to an interpretive research tradition (Walsham 1993; Klein and Myers 1999) in which reality is assumed to be socially constructed. The interpretive approach assumes no predetermined relationship between information technologies and social contexts. As researchers we thus “[seek] an understanding of

the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993, page 4-5).

The methodological strategy of this study is based on the qualitative research paradigm. We are inspired by ethnography in particular, and rely to a large extent on participant observations as a primary method.

The empirical material was collected from May to December 2005. In addition to observing work, we conducted semi-structured interviews, engaged in informal discussions, analysed various documents and participated in internal project meetings.

In total we conducted 80 hours of observation, including nursing handovers, interdisciplinary meetings (e.g. cardex and treatment meetings), and the process of updating the nursing plan and writing reports. Handwritten field notes were transcribed shortly after each observation session. While observing, we made an effort to cover different types of actors and interactions in order to highlight potentially different interpretations of what was going on.

Fifteen interviews were conducted. The interviews lasted an average of 1 to 1.5 hours. In addition, we spent some time in project meetings as well as studying various documents, such as project specifications, newsletters and training material. The overall process of collecting the data was open-ended and iterative, with the earlier stages being more explorative than the later ones.

The analysis of the data is based on a hermeneutic approach, where a complex whole is understood "from preconceptions about the meanings of its parts and their interrelationships" (Klein and Myers, 1999). This implies that the different sources of field data are all taken into consideration in the interpretation process.

Case

Implementing the nursing module

The introduction of the electronic nursing module took place in the context of a larger, hospital-level implementation of a new EPR infrastructure, also containing a nursing module. A decision to replace the existing EPR, in 2003, marked the start of a prolonged undertaking to create an all-encompassing information infrastructure cutting across departmental and professional boundaries.

The Department of Special Psychiatry was highly motivated to implement the nursing module in its four wards. Expectations related to improved efficiency and a better overview of the planning process were also important. Not only should it improve the care provided by nurses; another important aspect was the way it could facilitate coordination of work across disciplinary boundaries.

"I believe that this system [care plans] might help us better articulate what we do. I believe this is a huge challenge within the psychiatric sector: that we are able to explain to others what we do and how we think" (Nurse).

The implementation process was carried out over a half-year period. Three persons (two nurses and one secretary) were recruited internally to run the project. For two days a week, they were able to pay full attention to the implementation of the nursing module in the department's four wards. After some months of in-house training, the system was introduced in February 2005, both in the psychogeriatric ward and in the three other wards in the department. By May 2005, all wards had started to use the new nursing module.

The nursing module included functionality for writing daily reports and for creating nursing care plans - one plan per patient. The first part was the report section, where users wrote reports on a patient several (usually three) times a day. In this section, the users could write free text (that is, construct a narrative of the patients' problems). The second part was the nursing care plan. Unlike the report, it was highly structured and contained international codes for identifying diagnosis and related interventions for a patient.

The nursing plan was based on the NANDA and NIC classification systems. A NANDA diagnosis might spawn one or more NIC interventions. Also, for each NIC intervention there might be several ordinances or instructions (direct actions). The ordinances are written as plain-text extensions in the plan (see figure 1).

Treatment elements	FA	Frequency/situation	Start	End	Status
<input type="checkbox"/> Nursing diagnoses					
<input type="checkbox"/> Anxiety -- rt confusion	2		09.08.05		Active
<input type="checkbox"/> Impaired mucous membrane	4		30.08.05		Active
<input type="checkbox"/> Insufficient sleep	8		10.08.05		Active
<input type="checkbox"/> Nursing interventions / Ordinances					
<input type="checkbox"/> Reducing anxiety -- Objective: security, patient trust	2		09.08.05		Active
<input type="checkbox"/> Wake up before breakfast		Always	30.08.05		Active
<input type="checkbox"/> Encourage sleep	8		09.08.05		Active
<input type="checkbox"/> Make sure the patient get enough sleep			09.08.05		Active
<input type="checkbox"/> Consider medication		Together with physician	09.08.05		Active
<input type="checkbox"/> Record sleeping pattern		Make list, record in report	09.08.05		Active
<input type="checkbox"/> Help patient maintain diurnal rythm			09.08.05		Active
<input type="checkbox"/> Sense of reality	2		09.08.05		Active
<input type="checkbox"/> Clear messages about what to be done during the day		Written, Oral	09.08.05		Active
<input type="checkbox"/> Improve feeling of security -- introduce yourself, tell when you are about to finish your watch, offer contact	2		23.08.05		-----
<input type="checkbox"/> Heal wound -- No denture lower jaw; objective: prevent wound in the gums	6		30.08.05		-----
<input type="checkbox"/> Activity-therapy -- follow week-schedule	7		23.08.05		-----
<input type="checkbox"/> Independent nursing ordinances					

Fig. 1: The nursing plan with diagnosis, interventions and ordinances

The user writing the report was expected to use the plan with its diagnosis, interventions and instructions as a basis for the reports. Whenever deviation from the plan occurred, it was supposed to be documented in the report. As a result, the content of the report was kept to a minimum:

“The goal is to write as little as possible in the report, and to write in relation to what is in the nursing plan and describe any deviation from it” (Project group nurse)

In other words, the written report and the nursing plan were mutually dependent. For a complete understanding of the case, the users thus had to read them both. The plan provided the current status of the patient's nursing diagnosis (problems) and interventions, while to understand how it had evolved the nurses had to read the written reports. Deviations from the plan, what had happened over time, and how the nursing plan had changed were only documented in the reports.

In use, the nursing module was considered to be successful, especially by the nurses. It was also argued that the plan facilitated communication and had potential:

"People attending the meetings have already read the reports and the nursing plans. So now we focus on the core of the case (...) and we don't have to read everything aloud in the meetings" (Nurse).

"After having used the system for a while, I think we will improve and become more precise in what we write in the reports" (Nurse).

Two important arenas for information sharing

As indicated by the quotations above, nursing plans were assumed to enhance information sharing within and across disciplinary boundaries. In this ward, it is in particular at regular meetings that the various professionals meet and try to make sense of patient cases. One obvious reason for this is that the physicians have responsibility for patients in several wards, and thus are not always available outside the regular cardex meetings. Likewise, for the nursing practitioners, the meetings between working shifts are crucially important in ensuring coherence and continuity over the patient trajectory.

The interdisciplinary *cardex meeting* is held twice a week. Its main purpose is to clarify and exchange patient information and discuss further treatment. The name, *cardex*, denotes the presence of the various documents holding information about patients, and in particular the medication charts. The meeting is held in the conference room, which is the only room suitably configured for such occasions. The room contains a very large conference table with a dozen chairs around it. In one corner is a computer, the only one in the room. Its screen is positioned away from the centre of the room, so that it is visible only to the person using it. A projector is safely fastened to the ceiling above the conference table, and on the wall behind the door is a large whiteboard. The whiteboard is extensively used. It holds an overview of all the patients, indicating their names, the main therapist and care provider, their follow-up status and going-out status, and in some cases general information such as the date and place planned for the patient's discharge from the ward. Finally, next to the whiteboard is a small table holding various magazines, registration forms and documents.

The *cardex meeting* is well organized. It has a prearranged division of labour and a given sequence of action. Managing the process is the coordinator, usually a nurse. He or she is the only person with direct access to the EPR during the meet-

ing. The coordinator thus initiates the individual reports by browsing through the various documents and forms found in the EPR. During this process, an oral account is produced on the spot. Another nurse has been assigned the role of taking the minutes. She makes sure that vital questions and decisions are recorded in the minutes of the meeting. Also present are the physicians. They have been delegated the responsibility of handling medical concerns. Hence on the table in front of them are the medication charts, filed in one large binder. The remaining participants (nurses, physiologists, physiotherapists, etc) listen and, whenever appropriate, fill in with comments and questions. Typically, everybody brings a personal notebook. From time to time during the meeting, they make their own personal notes in their notebooks.

The *handover conference*, on the other hand, is vital in ensuring continuity between shifts. Only nurses are present during these meetings, which are essential as they provide the nurses with an arena to informally debrief, clarify and discuss patient information. In this ward there are four handovers a day, of which two are considered to be main handovers. The main handovers take place between the work shifts in the morning and in the afternoon. Like the cardex meetings, the main handover conferences take place in the large conference room. Two key tasks are carried out during these meeting. First, an oral briefing is given for each patient, primarily based on the written reports from the last 24 hours. Second, day plans are set up for the individual patients. In this respect the handover conference typically drifts from collective discussion to individualised preparation (planning).

Typically, an experienced nurse is delegated the task of coordinating the meeting. His or her description of the state of affairs is put across as a story. Various artefacts are used during the process, such as the written report, the ward list, and the whiteboard. In fact, as the coordinator does not have a complete overview of all patients, this presentation is highly reliant on the availability of a mixture of patient representations.

Analysis

The analysis is structured as follows: Firstly, we present the nature of CIS as where the work trajectories of physicians and nurses intersect (manifested by the intersection points of physicians' and nurses' work trajectories) as situated, temporal, regularly (re)negotiated and achieved in practice. Secondly, we discuss how medical data is not fixed and self-contained, but evolves over time during the patient's illness trajectory. Thirdly, we analyse the trajectory of the nursing plan and highlight its uncertain and contingent character.

CIS: temporal, contingent and achieved in practice

Instead of perceiving CIS as a common resource or shared space fixed in time and space, we argue that CIS is a short-lived arrangement, achieved in practice, and that constantly needs to be renegotiated. We develop our argument by focussing on the negotiations between physicians and nurses in interdisciplinary meetings in the course of the patients' illness trajectory. In their research on oncology protocols, Timmermans and Berg (1997, p. 276) argue along similar lines:

“[E]ach actor follows a trajectory which refers to a past, a present, and a possible future' (...) The doctor who orders the protocol, while, for example, following a research trajectory, sees the patient as one case in a project. The trajectory of the nurse who administers the protocol might be characterized by the tasks of her shift”

Following a similar line of argument, we argue that the CIS around a patient can be conceptualised as multiple disciplinary trajectories with only brief intersection points where the different professionals coordinate their activities. Below, this is spelled out more specifically by illustrating two of the most common trajectories, the care trajectory associated with nurses and the medical trajectory associated with physicians. Consider the first treatment meeting where the professional team of care providers tries to make sense of the case, including collecting information from very different sources. Notice in particular how professional boundaries delimiting the work of physicians and of nurses are being maintained and 'reinforced':

“Typically the nurses would be delegated the task of collecting information from home care, nursing homes and the like. The physician [responsible therapist] would be responsible for talking to the primary [referring] physician and ensuring that appropriate testing and examinations are carried out. For instance, Madres, MMS, Obsdement (...) and filling out the proper forms, etc. The psychologists carry out neuropsychological testing (...), we have a social worker who takes care of the individual plan, the physiotherapist has to do his thing, and so on” (Physician)

A similar situation occurs when the patients are discharged from the ward, only now in the opposite direction. The nurses prepare their own summaries for the nursing home, while the physician produces a formal discharge letter for the general practitioner. Accordingly, different artefacts and information sources (discharge letters, nursing summaries, etc.) enforce different professional perspectives.

However, if we look more closely at the heart of the interdisciplinary work in the ward, namely the interdisciplinary meetings, we can sense how the intersection points between physicians and nurses are really of a *momentary and contingent* character. The following field-note extract from a cardex meeting illustrates this:

The coordinator (Lisa) is managing the process. Positioned behind the computer, she is going through the information for all the patients in the ward based on the patient ward list in the EPR. Also seated at the table are the three physicians. On the table in front of them is a large binder holding the medical cardexes as well as the Physician's Desk Reference book. The rest

of the staff is spread around the room. Based on the nursing reports in the EPR, the coordinator has started to elaborate on recent changes and the current status of a patient with anxiety and extreme hypomania:

Coordinator: *“The patient claims that she has benefited from earlier stays”*

Psychologist: *“Her son says that she has been taking better care of herself since the transfer to the nursing home?”*

Having remained in the background, silently listening to the discussion, the head physician interrupts the psychologist:

Head physician: *“Only standard specimens have been ordered for this patient...?”*

The head physician’s head is bowed as he carefully reads the laboratory requisition lying on the table in front of him. He has the full attention of the other two physicians in the room. With the physicians’ attention on the laboratory requisition, one of the nurses has started talking to the rest of the staff:

Nurse A: *“The patient had a tendency to complain about her own disorder. We have however made it clear to her that there should be no talking about her own disorder in the day room”*

With this comment, nurse A is in fact not responding to the comment made by the head physician, but rather adding details to the account put forward by the coordinator. The staff’s attention is directed towards the coordinator. Meanwhile, the three physicians have quietly started an internal discussion about the specimens ordered. They are still occupied in this discussion as the coordinator ends the overall brief (signalling that the nurses are done) by asking if anyone has any further questions. There is no response and they move on to the next patient.

For the next patient, a similar situation emerges. In this case, however, one of the physicians replies to what the coordinating nurse says:

Coordinator: *“The patient’s mood is unstable. He starts sweating rather quickly. Participated on a trip to Prestevannet earlier today and was very satisfied with that”...*

Physician A, whose attention suddenly seems to have been attracted, interrupts the coordinator:

Physician A: *“Sweating???”*

Coordinator: *“Well... like he was tense ...”*

Another physician, Physician B, writes something into the medical cardex, while at the same time looking in the Physician’s Desk Reference (a book describing medication).

Physician B: *“Maybe we should reduce this specific medication”*

Physician B points at the patient chart, whereupon a discussion about medication starts between the three physicians. Physician B grabs the Physician’s Desk Reference book and opens it again. The rest of the staff is silently listening; some are occupied with writing information into their own personal notebooks. For instance, a nurse makes a note in her notebook to remember to call the homecare service, and the psychologist writes something in her personal calendar to remind her that a specific test needs to be taken. The professionals collectively agree on booking a treatment meeting for this patient.

Having completed the meeting, the various professionals (the nurses, physician, psychologist, etc.) would often write separate reports on what has been said and decided in the meeting.

Although both nurses and physicians want the best for the patient, they have different goals, practices and perspectives, making complete information sharing

illusiv. Work around a patient should rather be seen as taking place in parallel paths. At certain (intersection) points in the meetings, the various professionals poll the others, checking for potential changes to their own work.

In this light, the nursing plan is merely one element in a larger infrastructural arrangement, reflecting the nursing perspective on the care process as the cardex does for the physicians.

The evolution of medical data over time in the course of the patient's illness trajectory

Medical data is often considered to be fixed, self-contained and independent. In this sense, these data are considered to be pure facts, and all that is necessary to see. However, regarding medical data as "isolated givens, overlooks how medical data mutually elaborate each other" (Berg and Goorman, 1999, p. 54-55). One such mutual elaboration is how medical data evolves over time: "[i]n the course of a patient's illness trajectory, data items are constantly reinterpreted and reconstructed" (Berg and Goorman, 1999, p. 55). This underscores the temporal dimension with illness trajectories and accordingly how "[t]emporality (...) lead[s] to expectations about the future based on past events" (Reddy et al. 2006, p. 48).

To illustrate this, Berg and Goorman (1999) showed how the sequence of blood pressure measurements of a post-operative patient in an Intensive Care Unit (ICU) was tightly interconnected:

"Consider the following sequence of blood pressure measurements in the post-operative patient mentioned above: at 6 am, 120:70; at 9 am, 125:75; at 11 am, 115:65. If all other clinical signs would remain unchanged, then this series of readings would be most likely read as a 'stable blood pressure'. But if the 1 p.m. reading were to be 100:50, then the 11 am reading would be reinterpreted as the beginning of the decline" (Berg and Goorman, 1999, p. 54-55).

A key problem for the nursing plan was exactly that it was not able to support an "evolvment" view on medical data on the patient's illness trajectory. It could only show the current status (diagnosis and interventions). As these data were dependent on each other, the nursing plan was used less than expected. Below, we elaborate on this problem by focusing on an extract from the field notes made during a handover conference. Among the four handover conferences during a day, this one is taken from the one carried out in the afternoon:

With only nurses present, main handover conferences are normally carried out in the conference room. Typically, an experienced nurse is delegated the task of coordinating the meeting, and today Anne has been assigned this role. Her description of the state of affairs is put across as a story. During the process various artefacts, like the written report, the ward-list, and the whiteboard, are used. In fact, not having the complete overview of all patients, her presentation is highly reliant on the availability of a mixture of patient-representations.

Anne has positioned herself behind the only computer in the room. On the screen in front of her is the ward list. It holds an overview of all admitted patients and provides access to the individual records during the brief. The ward list is visible only to Anne, so during the discussion reference is frequently made to the comparable overview found on the whiteboard. The

whiteboard is the only visible description of patients which is observable for all nurses during the handover. Anne starts off with the first patient:

Coordinator (Anne): *“The patient has been isolated this weekend due to aggressive behaviour. As you can see on the whiteboard, he has one-to-one follow-up.”*

Handling the patient requires a considerable effort from the nurses. Behind the patients’ name on the whiteboard, a column called ‘going-out status’ says *“No going out”*, while another one called ‘follow up’ says *“one to one”*. The oncoming nurses’ attention is now directed towards the whiteboard.

Anne continues: *“The nursing care plan has been changed. Suicide is no longer a risk, so it has been removed from the care plan.”*

Anne’s remark about changes in the care plan is not deduced from the care plan module in the EPR, but from the last written report. In fact recent changes in the care plan are only to be found in the written reports. The care plan module only holds an up-to-date overview of nursing diagnosis and interventions. Hence identifying changes in the care plan entails having to browse through separate written reports:

Nurse: *“The electronic nursing care plans provide only the status, and not how things change over time”*

Anne has opened the nursing care plan to refresh her memory on the patients’ current status. It does not seem necessary to add anything more, so she closes the window on the screen and looks at the rest of the group.

Anne: *“The patient is isolated in his room, but with the door open. One nurse is always nearby to keep him safe”*

She is interrupted by one of the incoming nurses: *“But the patient loves to go for a walk...”*

A discussion arises among the nurses regarding the patient’s ‘going-out status’. On the one hand the aggressive behaviour of the patient makes him difficult to handle; on the other hand outside access is an important part of the therapy.

Anne follows up on the patient: *“Today, when [nurse] Lise had her lunch, I sat in isolation for about an hour with the patient. He really seems nervous. Besides, he also had an [ECT] today.”*

Electroconvulsive therapy (ECT), a rather controversial treatment method, is normally used when other forms of therapy, such as medications or psychotherapy, have not been effective. Usually ECT treatment is given three times a week for a month or less. Anne is trying to search backwards in the written reports to find out when the series of ECT treatment actually started, but is unable to find it. The remainder of the handover is accomplished in a similar way. An account is given for all patients. Typically all written reports from the last 24 hours are used. Occasionally older reports are studied, as when Anne was trying to find out when the ECT series had started.

This field extract underscores the importance of an historical overview of how medical data changed and how the patient developed. The nursing plan was therefore only used to a minor degree in handover conferences. Instead, the users still focussed on the reports. One of the nurses explained:

“We have some really unstable patients and this means that the plan changes all the time (...). We need to trace the changes that are made for the different entries and themes in the nursing plan (...) look at this! This is hopeless [she is pointing at the nursing plan]. Here are some im-

portant data from 08.02, but it is not possible to see how they have changed. The patient has had a lot of different wound treatments, but I don't even know when the first one was done"

This sequence illustrates how the patient developed (improved) along his illness trajectory. Perceiving this directly in the nursing plan alone is impossible. Also, this situation provides an overview of how long an intervention has been active. In contrast, the nursing plan did not provide information about when a diagnosis was initiated and the measures were taken out of the reports and put in the nursing plan; it only gives an overview of the current situation.

As elaborated in the field note extract above, suicidal patients can never go out alone, but must always be accompanied by one of the health personnel. Therefore, the two related parameters: 'going-out status' [whether a health worker needs to accompany the patient] and 'follow-up' are extremely important for the resource management in the ward; not least how these parameters develop:

"We are very interested to see how the patient develops. For me as a night watch nurse, covering several wards, it is particularly important (...) For instance, at one stage, you could see that the patient was not allowed to go out on a given date. Some time later, he could go out accompanied by two staff members, and at the moment, he must be accompanied by one staff member, etc."

The uncertain and contingent character of the nursing plan trajectory

It is often "thought that the trajectories of technological projects are contingent and iterative" (Law and Callon, 1992, p.49). From this perspective, implementing a large information system (cf. the nursing plan) into an organisation is seen as a rational process where goals, a clear overview and good planning lead the way to a given outcome. Sometimes, to be sure, this will be the case. However, "[there is] no necessity about such a progress. If all is smooth, this is because contingency has operated in that way" (Law and Callon, 1992, p.50).

For instance, an information system may appeal to a new reality, and become something completely different. In this case, the nursing plan turned into a resource management tool. Resource management in the psychogeriatric ward was a complex issue, depending on the current condition of the patient, the legal clauses in effect, the going-out status and follow-up. 'Going-out status' indicates whether a health worker needs to accompany the patient outside the ward or not. 'Follow-up' indicates what kind of attention a patient might need, and how often. Having a good overview of such issues was extremely important as "suicidal patients can never go out alone, but must always be accompanied by one of the health personnel" (Nurse). The rhetoric around the plan was modified to include resource management as well:

"The ideal situation would be to document going-out status and follow-up in the nursing plan; then we could have an overview of the resources needed and how they developed" (Project group nurse)

The users themselves had a key role in the transformation process of the plan. Even if the important factors, going-out status and follow-up, were not explicitly part of the plan, the staff used them implicitly to obtain an overview of the resources needed:

“By reading this plan, I can see that this patient will require a lot of time and resources” (Nurse)

Also in the maintenance of the nursing plan, it became increasingly important to include the resources needed. For instance, when a nurse was updating the nursing plan, one of the project leaders passed by and reminded her to include the staff resources needed:

“You must include that this patient needs one-to-one follow-up (...) we have to be precise about which resources are needed in order to succeed with the nursing plan” (project group nurse)

Although it had been intended primarily as a vehicle for tracking the ongoing delivery of nursing care, the nursing plan implementation process became increasingly entangled with managerial concerns for resource management and control. The use of clinical information was thus lifted out of its primary context in order to be used for completely different purposes.

Conclusion and implications for CIS

This paper develops a perspective on how to conceptualise CIS in which various perspectives are accounted for. We explore how CIS are *achieved in practice* by drawing on the notion of trajectories. A perspective on CIS is developed that emphasises its situated, temporal and negotiated nature. We demonstrate how it encompasses several disconnected trajectories (professional, medical and technological) and how each follows its own logic only with brief intersecting points. Also we stress the *temporal* dimension of the multiple trajectories - and how they evolve over time in the course of the patient's illness trajectory. Based on this, we call for a furthering of the discourse on trajectories and temporality within CSCW. From a practice perspective this implies adhering both to objective and subjective perspectives of time (Orlikowski and Yates, 2002) and how work unfolds along different temporal dimensions.

Ambitions, aims and goals related to medical technologies change and expand over time and in relation to multiple stakeholders. For example in our case, the nursing plan started out as tool for nurses, yet gradually turned into a resource management tool. Whether this is a trend that ultimately will turn the nursing plan into a major tool for management is of course too early to judge. Nevertheless, such transformations of ambitions are typical of information system projects and should not come as a big surprise. Primary work transforms into something different, and where technologies find new areas of application.

Implementing the nursing plans with the aim of improving information sharing is extremely difficult. In order to succeed, the first and indeed most important thing to do is to move beyond simplistic strategies of replacing the existing information sources. The strategy to pursue is rather to find mechanisms that strengthen the relations between the different nodes. Implicitly this also involves paying closer attention to the non-common – that is, the information that remains local to the various professionals. In this respect, we call for the need to rethink ‘implication or design’ by focussing more on process rather than the product.

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