

Enacting knowledge work: the genealogy of knowledge representations in hospitals

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Abstract. Given that knowledge (intensive) work takes place immersed in truly heterogenous networks of knowledge representations (codified, narrative, embedded in routines, inscribed in artefacts), our analysis is geared towards how the transformation of these resources are enacted in the practise of everyday, knowledge work. First, we discuss the work, strategies and mechanisms implied in the rendering of knowledge as credible, trustworthy and relevant. Second, we analyse how sediments of historically superimposed layers of knowledge need to be enacted through selective repetitions, omittance and highlighting to preserve it as `living` knowledge. Third, supplementing the more intellectually oriented aspects of knowledge work, we discuss the organisational complexity of coordination and delegation and the role of externalised knowledge in achieving this. Empirically, we study clinical work in large hospitals, a type of work, we argue, that unduely has been left out of traditional listings of knowledge workers.

1. Introduction

The establishment of knowledge (intensive) work as a research theme has spawned considerable interest into characterisations, typologies and underlying conditions for this kind of work (Zack, 1999; Blackler, 1995; Nonaka and Takeuchi, 1995; von Krogh, 1998). Yet, as Alvesson (2001) so timely reminds us, this does not avoid the distinct bias in much of the

approaches, definitions and conceptualisations of knowledge work as they are 'likely to be contestable' (Alvesson, 2001:864).

The preoccupation, bordering on obsession, with engineers, designers and consultants needs to be recognised as ideologically rather than analytically founded. Sturdy (1997), for instance, presents a picture of consultants and consultancy work as routinised and haunted by anxieties about staging a facade of expertise both to clients as well as to colleagues. It is neither obvious nor 'natural' that characteristics of knowledge work as specialised, requiring a high level of formal training and innovative translate into the kind of work listed earlier. To take but one example, Knorr-Cetina (1999) argues convincingly that the organisation of work within scientific laboratories – currently under intense pressure to transform - might very well function as configurations of knowledge work more in general (see also Boland and Tenkasi, 1995).

This apparent lack of precision in the conceptualisation of what constitutes knowledge work does not, however, imply that the term is void for further analysis as "it makes sense to refer to knowledge-intensive companies as a vague but meaningful category" (Alvesson, 2001:864). On the contrary and in resonance with Searle's (1985) more general principle, ambiguity signals an interesting and productive setting for further analysis. The only lesson to be drawn from this is to approach the notion of knowledge work with sufficient caution.

The study reported here focuses on clinical work (diagnosing, treating, curing and checking patients) within large hospitals. For the reasons indicated above, the clinical work of physicians in hospitals tends to get bypassed in most discussions on knowledge work. This is unfortunate as clinical work – highly influenced by the scientifically legitimised knowledge production, involving highly educated personal, characterised by interdisciplinarity, subject to high degrees of risk – provides an instructive occasion to study knowledge work in action.

There is clearly a cognitive complexity to clinical practise: puzzle solving over diagnosing, keeping updated on recent research progress and medications. Still, the complexity and aspect of knowledge work we emphasise here is linked to the intrinsically *distributed* character of clinical work as "a diagnosis...can be not only cognitively, but also socially complex" (Cicourel 1990:222). There is, quite literally, no single individual who possesses the complete knowledge about any given patient. Rather, it is dispersed throughout a truly vast, heterogeneous network of individuals, communities, archives and information systems (Berg, 1996; Berg, 1999; Strauss et al., 1985; Atkinson, 1995). This observation marks the point of departure of our analysis that subsequently evolves along three themes.

First, the bringing together or *orchestrating* of the many forms, sources and representations of knowledge is analysed. Moving beyond simplistic dichotomies like, say, tacit/ explicit knowledge representations, we dwell on the practices for rendering knowledge (regardless of representation) credible, relevant and trustworthy. It is not immediately obvious which forms of knowledge is credible and what is less so. Sorting this out involves work like double checking by looking the same information up in an alternative source, discussing it with members of your community and relying on your existing network of already established. The emerging knowledge develops by a fluid interleaving of the various sources and forms of knowledge representations; it is orchestrated.

Second, this process is furthermore characterised by the *enactment* of the various elements in the heterogenous network rather than a mere ‘collecting’ of given elements. Knowledge is moulded and crafted through re-presentations, thus creating a genealogy of sediments of different layers of knowledge representations. Despite the apparent repetitious nature of the ‘gathering’ of knowledge elements, the crucial task in knowledge work is to re-vitalise them by revoking or enacting them. A crucial aspect of this process, which more often than not tend to be glossed over in accounts of knowledge work, is the preservation of earlier accounts while at the same time adding new layers, new versions. In keeping up with the vast, accumulated body of knowledge of a patient (history of hospitalisation, accounts from other departments and laboratories), it is crucial to craft, mould or narrate a more manageable trajectory which also serves as an ‘organisational memory’. These summaries act, to use Bowker’s (2002) phrase, as ‘folded histories’ as they selectively enact historically buried knowledge.

Third, the knowledge representations also play productive roles beyond feeding into the knowledge work itself. They are key vehicles in the actual *organisation* of the work as they coordinate, delegate and distribute work across time and space and professional groups (communities) (Berg, 1996; Berg, 1999; Huthchins, 1994; Smith,1990:210). How knowledge work actually gets organised is a downplayed aspect of the complexities of this kind of work at the expense of the intellectual (Boland and Tenkasi, 1995), social networks (Blackler, 1995; Lave and Wenger, 1991; Brown and Duguid, 1991; Nonaka and Tacheuchi, 1995) or empotional (von Krogh, Ichijo and Nonaka, 2000) aspects. Beyond pure knowledge representations, utterly mundane artefacts such as forms, sheets and reports simultaneously function as tokens signifying the completion of one task and the handing over of the responsibility to someone else.

Empirically, we analyse so-called discharge letters. Their production provides a particularly relevant instance of the themes outlined above. The discharge letters are worked out by the physicians upon the departure of the patient from the hospital. Rather than ‘collecting’ the ‘facts’ of what happened during the patient’s stay, it is an occasion for enacting and orchestrating the distributed knowledge representations, crafting it into a narrative useful for its recipients who predominantly are physicians in primary health care (the patient’s general practitioner) or physicians at the patient’s local hospital. In addition, they are used by the hospital physicians themselves whenever the patients return to the hospitals. They accordingly are the topmost layer of the genealogy of the body of knowledge representations that in sum make up what ‘the hospital’ knows about a patient; they are the revoked remembrance of a patient’s trajectory.

In section 2 we outline our framework for conceptualising knowledge work. We emphasise the importance of communities of practice, the heterogeneity in knowledge representations and the historicity of knowledge. Section 3 outlines the setting of the study at the University hospital of Northern Norway (UNN). It also discusses methodological issues. Section 4 contains four case vignettes from different wards at the hospital. The analysis is contained in section 5 and is structured as indicated above into the orchestrating, the enactment and the organisation of knowledge work. Concluding remarks are offered in section 6.

2. Conceptualising knowledge work

The deeply social aspects are a pronounced theme in much of the writings on knowledge work. It is, rightly so, pointed out how social networks in general and communities of practices in particular capture an important way in which knowledge is formed, created and circulated. Learning and knowledge sharing does not take place isolated from or ‘above’ social interaction; it is an intrinsic part of the constitution of communities (Lave and Wenger, 1991; Orr, 1995; Nonaka and Takeuchi, 1995). An aspect of how knowledge circulates within a community of practice is the emphasis, inspired in part by Bruner’s (1986) arguments, of the narrative format of knowledge. Being a knowledge worker thus means being involved in learning and creation of new knowledge through becoming and ‘insider’ in the community (Brown and Duguid, 1991:48), that is, they are acquiring not explicit, formal “expert knowledge, but the embodied ability to behave as community members”. This strand of studies of knowledge work explores how narratives are formed and how they operate in communities (see Orr, 1995; Boland and Tenkasi, 1995, Brown and Duguid 1991;

Czarniawska, 1997). Within health care, the importance of narratives have also been emphasised (Atkinson, 1995; Hunter, 1991). Hunter (1991: 69) underscores the intimate and irreducible nature of both written and oral knowledge:

“Physicians refer to written materials in the production of their spoken performances; the latter may provide the basis for subsequent written texts... a sharp distinction between ‘literate’ and ‘oral’ aspects of culture is misplaced in many instances: it is undeniably true of the culture of medicine”

The focus on narratives, taken to the extreme, may encourage a portrait of knowledge as essentially social and irreducibly by coding as one of the positions suggested by Lam (1997:979):

”Knowledge is generated and stored ‘organically’ in team relationships and the mode of coordination is human-network based. This type of knowledge is not amenable to systematic codification and can only be accessed and transferred through intimate social interaction”

This downplays to the level of non-existence the role of externalised or codified representations of knowledge, a position which ultimately is unattainable (Nonaka and Takeuchi, 1995).

The key issue, then, is to explore how a network of heterogeneous representations of knowledge gets orchestrated or brought together to a (reasonably coherent) body of knowledge. This involves, as Boland and Tenkasi (1995:359) point out, an element of validating or sense-making of the different elements:

“In summary then, the problem of integration of knowledge in knowledge-intensive firms is not a problem of simply combining, sharing or making data commonly available. It is a problem of perspective taking in which the unique thought worlds of different communities of knowing are made visible and accessible to others”

The dichotomous distinction heralded by Nonaka and Takeuchi (1995) between so-called tacit and explicit knowledge sidesteps the key issue of describing the work, efforts and strategies of rendering knowledge understandable, credible and trustworthy. Large organisations, including large hospitals, need to cope with what Giddens (1991: 21) argues to be an increasingly important aspect of the modern world and describes as “disembedding”, that is, “the ‘lifting out’ of social relations from local contexts of interaction and their restructuring across

indefinite spans of time-space". An essential aspect of this is how processes of "re-embedding" need to re-establish social links, networks and communities of practise.

As convincingly demonstrated in later studies in knowledge management, externalised materialisations of knowledge (likely to face "disembedding") require a social embedding (Lam 1997; Nonaka and von Krogh, 2000). The question, then, is how do organisations preserve the deeply social aspects of knowledge production under the increasing pressure of disembedding processes? On Giddens' (1991: 79-80) account, modern societies and organisations have to increasingly trust "abstract systems" implying "faceless commitments". Hence, this delegates a pivotal role to establishing, maintaining and extending trust as a necessary basis for knowledge work and knowledge cultivation.

The kind of trust involved in knowledge work is not a static entity either present or absent. It is rather the performed achievement of a concerted and highly heterogeneous effort with actors, artefacts and other externalised knowledge representations. As pointed out by Cicourel (1990:222), "the perceived value of medical information is related to the perceived credibility of the source". An important aspect of knowledge work, then, is to unpack how disembedded or externalised knowledge is rendered credible and trustworthy. This problem is dramatically reinforced in settings, including modern hospitals, with extensive generation of externalised knowledge.

Large hospitals depend heavily on textual practices, which co-ordinate, order, provides continuity, monitor, and organise relations between different segments and phases of organisational courses of action (Smith, 1990:217-218). This points to that text is never neutral, which is also pointed out by Atkinson (1995:127):

"Not all knowledge is treated as having equal value. It has different sources, and has different weight attached to it, and may be regarded as more or less warranted (...) in expressing his or her attitude towards facts and opinions, the clinician also inscribes aspects of the moral and technical division of labour among medical specialist".

Documents or texts are visible constituents of social relations (Smith, 1990:210). Texts contribute to "externalise social consciousness in social practices, objectifying reasoning, knowledge, memory (...) decision-making etc. as properties of formal organisation" as Smith (1990:210) point out before continuing

"The simple properties of the documentary or textually mediated forms of social organisation involve their dependence upon, and exploitation of, the textual capacity

to crystallise and preserve a definite form of words detached from their local historicity”

In the process of drawing this vast network of knowledge representations together – narratives, patients records, laboratory reports, notes – there is an ongoing effort of highlighting some elements at the expense of others. Or as Bowker (1997:15) puts it by paraphrasing Garfinkel’s classic paper, “I have argued that there may indeed be good organizational reasons for forgetting”. This points to the essential, but less developed, theme within studies of knowledge work, namely the layering or *genealogy* of knowledge representations. Bowker (2002:5 (emphasis added)) makes the relevant remark that “[t]here has been relatively little work in ... dealing with the organizational, political and scientific *layering* of data structures”. Truly vast bodies of knowledge cannot, quite literally, be maintained in full. Through ongoing, selective ‘forgetting’ and re-presentations they have to be enacted. Bannon and Kuutti (1996) make the timely observation vis-à-vis the problematic notion of ‘organisational memory’:

“if ‘organizational memory’ is at all a useful concept, it is so to the extent that it refers to active remembering which carries with it its own context – so that it comes in the form not of true or false but of multifaceted stories open to interpretation”

The layering or genealogy of knowledge representations implies that these representations need to embed some kind of historical context although “[w]e cannot retain everything about a set of data (this would be bureaucracy gone wild)...[we need] historical perceptions of data” (Bowker, 2002:33).

The amount of externalised knowledge in hospitals is significant. To illustrate, the paper based patient records at one of these hospitals (RiT in Norwegian, located in Trondheim) occupies 16 km of shelves. The specific task of physicians we focus empirically on in our study is the writing of discharge letters. These letters are to bring together the truly dispersed and heterogeneous knowledge representations of what ‘happened’ during a patient’s stay. Thus, the re-telling, revoking or enactment involved in writing the discharge letters goes well beyond a mere recombination of existing ‘facts’. It adds an interpretation and is crafted with a purpose in mind. In writing these discharge letters the physicians simultaneously add to the existing layers of historical accounts of the patient’s trajectory. Also, the narratives of these discharge letters involves the kind of perspective taking (Boland and Tenkasi, 1995) emphasise as a key recipient group is the general practitioners, a community of practice distinct from the hospital based physicians.

Berg (1996:5) reminds us that the mode in which clinical work takes place is geared towards ‘what to do next’:

“Through [the physician’s] activities of reading and writing (...) he narrows down the plethora of potential tasks and divergent data into a clear notion of ‘what to do next’”

One aspect of the ‘what to do next’ framing of knowledge work for hospital physicians, is the way externalised representations of knowledge – forms, reports, records – at the same time function as cues or tokens that feed into the coordination, delegation and accountability of the work, also of nurses, secretaries, physiotherapists and other professions (communities) at a hospital (Berg, 1996; Berg, 1999; Smith, 1990). Hence, ‘externalised’ knowledge representations also play a performative role in the everyday organisation of hospital work in total, an organisational complexity that exceeds any individual’s capacity (Hutchins, 1994). Knowledge work is thus not ‘pure’, that is, independent of and above the more mundane task of the organisation of everyday work. They are intimately tied up with each other.

3. Setting of the study

This study belongs to an interpretative approach to the development and use of information systems (Klein and Myers, 1999; Walsham, 1993). This amount to trying to make sense of the various sources of data I rely on by iterating between more theoretically motivated notions and more “raw” data.

We rely on four types of data: participative observations, interviews, informal discussions and electronic and paper based documents. The participative observations took place during January-Mars of 2001 at 4 departments at University Hospital of Northern Norway. The hospital has approximately 4000 employees, including 400 physicians and 900 nurses. The hospital has 600 beds in which 450 is somatic and 150 is psychiatric.

In total, 42 hours were spent observing work. In addition, the first author have conducted 57 hours of observation in four other departments. These were used as a background material.

In the four present departments the observations where especially aimed at work situations for physicians as they are recognised as a particularly important user group. Nevertheless, in some situations secretaries became involved, and in some meetings nurses were part of the group. On occasions, also patient examinations were observed. Questions were posed in order to clarify and elaborate observations. The extent and format of these obviously varied with what was possible without intruding too much with the ongoing work. So, for instance,

questions were postponed when the work was recognised as hectic, formal group meetings or in front of the patient. People did not seem to bother about being observed. This resulted in a fluctuation between a fairly passive role merely observing as non-obtrusively as possible and a more active role, when possible, posing questions for clarification and explanation. All together I conducted 34 semi-structured interviews during the periods mentioned above. Each interview lasted from 1-2 hours.

4. Case vignettes

Medical practice varies enormously – within different domains, departments, hospitals and countries (Atkinson, 1995; Strauss et al., 1985; Berg, 1999). We have no ambition of paying justice to this variation in any systematic or comprehensive manner. Rather, our aim is to motivate for an appreciation of this variation through a sampling of 4 wards at University hospital of Northern Norway. This variation in practice also translates into a corresponding variation in the generation and use of representations of knowledge about the patient. All the observations are especially targeted at the process of producing discharge letters. Characteristic features of the work situation in the wards are

- 1) *Dept. of Ear, Nose and Throat*: A small stable surgical, largely self-contained department where the patient cases are relatively clear set.
- 2) *Dept. of Cardiac and Thoracic Surgery*: An extremely hectic high-specialised department with relatively narrow problems of concern. Most of the patients have had a full investigation in another department.
- 3) *Section of Nephrology, Dept of Medicine*: A section with a lot of control patients related to chronic diseases. As a part of the whole Dept of Medicine however, the physicians experience a relatively high share of emergency cases with pretty unclear problems.
- 4) *Dept. of Oncology*: Most of the daily operations of the department are planned but due to complex diagnoses, the physicians have to deal with a high degree of uncertainty.

4.1. Department of Ear, Nose and Throat – overview and stability

Ear, Nose and Throat is a surgical profession with many small operations. This makes the cases relatively predictable. In order to ensure efficiency in the production of discharge

letters, the department routinely reuse documentation from the patient record. In the following I present the mode of work in the department:

The chief physician and a nurse, both wearing white clothes are present in one of the examination rooms. They prepare for the examination of 6 patients. The room seems very much alike an ordinary examination room, light colours on the wall, glaring light, a large desk with pile of documents, notebooks, short lists and one computer. In addition however, there is a large examination chair that can be adjusted into different positions. It reminds of a dentist's chair.

The patients have been at the department for a short stay and will leave today. The patients are admitted to the room in turn and asked to sit in the examination chair. Every one of them moves normally as well as looks healthy indicating that their current illness is marginal in relationship to their total health condition. As an example, one of them, a young student was hospitalised due to complications after he has had surgery of his tonsils and as the discharge letter states, "...beyond that, the patient is in good health". The chief physician very quickly examines the throat and the nose of the patients.

The conversation between the health personnel and the patients is easy-going and the chief physician often adds jokes to the conversation with the patients. At one instance, while cleaning an old man's nose the chief physician jokes with the patient's librarian duties and tells him to stay away from those dusty books. Even if the chief physician and the nurse at this time have to finish off several patients the atmosphere appears stable, relaxed and well-organised. The actual computer is not used during the work indicating that the chief physician has a clear sense of the patient's condition (he does to a minor degree need to lookup x-ray reports, laboratory results etc.)

Between each patient the chief physician dictates the discharge letter associated with the previous examination. To be more correct, he only dictates the last part of it, the conclusion which is carried out within 45 seconds and which amounts to five lines of text. This work also includes specifying diagnosis and procedure codes drawn from a short list of regularly used diagnosis codes.

The rest of the discharge letter is reused from documentation produced during the stay which indicates a certain stability of the knowledge. He checks off on a paper form, to instruct the secretary, which previous documentation to include in the discharge letter. For the student introduced above, he decides to reuse the summary of the admittance report (about 1/3 page).

4.2. Department of Cardiac and Thoracic Surgery – hectic and highly specialised

The Dept. of Cardiac and Thoracic Surgery is responsible for cardiac surgery for adults in the Northern Health Region of Norway as well as regional responsibility for general thoracic surgery. Most of the patients admitted to the department have received in advance a full examination by another department or hospital. The patients stay for approximately six days. After their surgery they are transferred to another department within the hospital or to another hospital. In this situation it is imperative to include the discharge letters in order to inform others of the patient's conditions, medications and further follow-up. The following vignette illustrates the work in the department:

About 10 persons are present at the morning meeting, one head physician and three assistant physicians. The rest is nurses that enter and leave the room depending on whether 'their' patients is involved. The discussions circle around the patients' heart surgery. The atmosphere appears very hectic and effective. Any disagreements about change in prescribed medications, further treatment strategies and whether patients is capable of leaving today are quickly settled.

One of the assistant physicians, Pasi, breaks from the morning meeting in order to produce a discharge letter on a patient that is leaving today. He goes to the on-duty room bringing with him the paper-based patient record which he places on a desk. First of all he picks out the admittance report and the surgery report from the previous day. He also picks out and reads the discharge letter from a stay at the Dept. of Medicine one month earlier where the patient has had a full examination prior to his surgery.

The on-duty room is crowded, physicians and nurses regularly come and go and there is a hum of questions, advises and discussions. On one wall it is a big board that coordinate the daily operations in the ward. The phone is constantly ringing. Surprisingly enough, this is the place where Pasi usually dictates the discharge letters. While ignoring the noise around him, he starts to dictate the social status for a patient that has had a heart surgery: "72 years old fisherman that lives together with his wife...". The dictation becomes very short. And as one of the head physicians puts it: It has to be short in order to quickly point to what this is all about. In his dictation, Pasi did not reuse the summary from the admittance report (as some do). He says: "I use it if it is good, but not always. Anyhow, most of the time goes to obtaining an overview of the case and then I have to read in the patient record. It might be that documentation produced some time ago is important. Surgical and medical texts are also very

different, which means that sometimes I have to turn to old documentation to get the whole picture. He also tells that as a very inexperienced assistant physician at this department, he had to read for 2 hours to get overview of a case.

He continues to dictate, it is rather staccato since he tries to make sense of information from several sources, both from the pile of papers as well as from the electronic patient record. He realises then that he needs the patient chart. He stops dictating, walks to one of the examination rooms, finds the chart and continues to dictate. He also reads and picks information from the nurse report. Once more, he stops dictating, picks up some medical measuring device and goes to the patient in order to measure her talus arm index. One moment later he is back and comments “no pulse in the foot, there is better circulation in the minor arteries, but not in the large ones”. As the last point, he has to check whether the patient needs to be summoned to a control. He leaves the room, searching for the chief physician. He finds him in one of the patient rooms, gets the necessary information and finishes the dictation.

Next, it is time to find a secretary that can write his dictation. Pasi hurries around and looks for a particular one of them. After he has found her, she gets the tape and starts to write immediately. Pasi goes back to the on-duty room, waits by the computer, ready to proof-read and sign the discharge letter as soon as the secretary has finished writing. In the mean time, the nurse responsible for the discharge of the patient enters the room and asks for the report. She is put under a certain strain since the ambulance air transport is ready to take off and leave for the local hospital and they need the report. Now both Pasi and the nurse is waiting and in couple of minutes it appears. Pasi proof-reads it and signs it where after the secretary prints it and gives the printout to the nurse. This whole process of producing the discharge letter has been quite resourcefully demanding, involving a lot of Pasi's colleagues in the department as well as use of a heterogeneous amount of information sources.

4.3. Section of Nephrology, Dept. of Medicine – specialised work for chronic patients

The Section of Nephrology is a part of the Dept. of Medicine. The section has a lot of control patients related to chronic diseases such as kidney failure. In addition, as a part of Dept. of Medicine, the section has to relate to a lot of emergency patients with unclear problems. Presented below is work from an experienced physician.

In an office in the Dept of Medicine a physician is making himself ready to produce discharge letters. The patients involved have been discharged from the hospital a

couple of days ago. On the desk, in front the physician, it is placed pile of patient records and one computer. On the front cover of several of the paper records it is written in large letters "RETURN DIALYSE". It means that these paper records are stored in the Peritoneal Dialysis (PD)-section in a special archive. Patients having these records come regularly as they are special patients. As a result, only the secretaries in the PD-section write these reports in order to ensure that everything is done right.

Right now the work situation for the physician seems stable and calm. However as the work session progress it is clear the several of these cases are quite complex, such as unpredictable emergency cases, several examinations in other departments, contacts with psychiatric sections, results from laboratories etc. He regularly stops dictating in order to check information from several sources, such as, blood results from the laboratory system as well as running notes, results from referrals and patient charts from paper records. He reads quite extensively and the reading and dictating occurs simultaneously. The physician also supplies his current work with phone calls to a couple of his colleges.

For several of the patients he turns to the x-ray-system, looks at x-ray pictures and reads the x-ray report where after he makes a summary of it on the fly as he dictates. He also includes his own assessments. Afterwards he says "Sometimes I can cut and paste parts of the x-ray report, it depends on how much is important".

One of the discharge letter is based on an emergency admission. This time he dictates partly the same information that existed in the admittance report. He says that the reason why he did not instruct the secretary to reuse the first sections was because the information in the admittance report was incorrect and he had to correct this information based on conversations with the patient and his wife. He also looks into the nurse reports and says: "You have to do that often to check whether it says something important". For the next patient, on the other hand, the physician instructs the secretary to copy from X to Y in the admittance report. Now the secretary will reuse this text. The physician says afterwards that he knew what the documentation contained because he had dictated the admittance report himself.

When he dictates procedure codes he stops and says: "This was not correct". Therefore he starts the code tool on the computer. It is used to find the right procedure- and diagnose-codes (NCSP and ICD). After a while he finds the proper codes and dictates them. He tells: "It is this coding that take absolutely most time in relation to the dictating of discharge letters".

The final patient is a chronic PD-patient. In addition to the dictation he retrieves the patient's complemented PD-form (see Figure 1) on the computer. He copies it and pastes it directly into the discharge letter. It contains a lot of important measurements related to the patient's condition. And as he says: This is a patient that regularly returns to the section and he needs clear cut rules for who is responsible for what. As is possible to see here (he points at the form), PET analysis is not performed during this stay, but down here (he points at the bottom of the form) you can see that it is decided that it will be carried out during the next stay. He also tells that when PD-patients are hospitalised it is a standard procedure to look into the discharge letter based on the previous stay in order see whether it is planned special tests

DATO	10.01.01
est. tørrvekt	87-88 kg
vekt	87-88 kg
urinmengde	2000 ml
dialysatmengde	12730 ml
ultrafiltrat	1000 – 1400 ml
blodtrykk	172/106
KT/V -egen	1,16
-totalt	3,09
Krea-clear	74,6 l/uke
PET	Ikke utført ved denne innleggelsen
Prealbumin/albumin	35
HB	12,6
jern	17
TIBC	62
ferritin	205
Ca /ion. Calsium	2,36/1,22
fosfat	1,92
PTH	20,4
Posestyrke	CAPD posestyrke Locolys 2,3 % 4 x 2 liter om dagen, 2,5 liter Extraneal om natten
Exit-site	Bra
Neste kontroll	1. Ved med.pol. hos MRU om 2 md med måling av restfunksjon. 2. Ny PD-kontroll med PET mai-02
Signatur	NN

Figure 1 The PD-form - a part of the discharge letter

4.4. The Dept of Oncology – collective sense-making

The Dept. of Oncology is the only one in Northern Norway and has the major responsibility for the cancer treatment in the region. Most of the patients are examined at a local hospital before they are admitted to this department. Due to the character of the disease, some of the patients are hospitalised for a relatively long time and some of the patients, due to treatment protocols, must regularly come to the department in order to get radiation treatments or chemotherapy. This makes most of the daily operations planned. The personnel experience

however a very hectic work environment during the day as a result of the large percentage of extremely complicated patients. Presented below is work by an assistant physician that has four months experience in the department.

It is six o'clock in the afternoon. We are in the assistant physician's office outside the ward. She is in the process of dictating a discharge letter. Due to the heavy daytime workload in the ward the discharge letters are generally dictated in the physicians' offices in the evenings, never in the ward.

The assistant physician explains that this is a new patient and therefore it can take some time until she finishes it. In addition, the discharge letters in this ward can be relatively extensive with little structure and come close to free text. She spends some time going through the paper record as well as retrieving information from the electronic patient record. She dictates extensively, describing the current situation for the patient. She logs into the x-ray system and reads the CT-description, makes a summary of it and continues to dictate. Part of her dictation shows that during the stay the physicians have discussed possible treatment alternatives. The patient has also been involved in these discussions and has insisted on trying a special treatment that the patient has become aware of may have effect on his diagnosis D1. The patient is now discharged from the department without any documented effect of the current treatment. The department will be waiting for further results, which once more may lead to hospitalisation for the patient.

After the stay the physicians have continued to evaluate the case and agreed to offer the patient participation in an ongoing research study outside the study protocol. This implies that the patient will get treatment T1. A problem is that the physicians don't know whether the patient also suffers from diagnosis D2. If so, normally treatment T2 would have been given, but the physicians have not combined the treatment T2 with the treatment T1 before. One of the involved head physicians recommends that they for this patient give treatment T1 and not treatment T2 even if it appears that the patient also suffers from D2.

The assistant physician works over half an hour with this discharge letter, which turns out to be quite extensive, that is, two pages of closely spaced text. Afterwards she tells that they treat many different types of cancer which are rather unusual in general practice and thus it is difficult to know what to be aware of, for instance possible side effects of certain treatments. These are rather specialised things and ought to be included in the discharge letters.

5. Analysis

5.1. The orchestrating of the heterogeneous network of knowledge representations

Knowledge about a patient in a hospital is represented in a truly dispersed and heterogeneous manner. There are numerous textual representations (some in paper, some in information systems) accumulated during the patient's trajectory through the different departments and laboratories (including physicians' running notes, nurses' documentation of treatment, laboratory reports, admittance reports and surgery reports) as well as graphical representations (x-ray images, CT- and MR scans and EKG printouts). In addition, there is a rich source of verbalised representations, the ongoing hum of discussing, reporting, joking and story telling of and around patients (Atkinson 1995: 90; Hunter, 1991: 5-6). As Atkinson (1995:91) underscores it:

“There is in the everyday organisation of medical work a close relationship between written and oral accounts constructed by medical practitioners for their colleagues”

Which is aligned with Hunter (1991:5-6):

“Storytelling events organise the medical day in a teaching hospital: morning report, professor's rounds, attending rounds, weekly departmental grand rounds, and, in a staccato shorthand, evening sign-out rounds”

Atkinson (1995:45) points out how medical knowledge influence not only the content of collegial talk but also the form of talk. Thus the knowledge creation and translation process is not only based on journals and textbooks (Atkinson 1995:90-91), but also includes extensive, ongoing conversations between colleagues, for instance clinical lectures, ward rounds, mortality and morbidity review and a surgeon's commentary to assistant physicians and students. In this understanding medical work, medical knowledge is enacted within an oral culture and the medical work is constantly produced and reproduced through a 'narrative encapsulation' of the knowledge.

Making sense of the patient thus invariably involves the bringing together of this vast network of heterogeneous knowledge representations. It is essential to recognise how this goes beyond an instrumental 'collection' of these representations. There is a considerable amount of *work*

– of a variety of types, more often than not taken for granted and rendered ‘invisible’ – that goes into the validation, double-checking and sense making of these representations.

Potentially disturbing to some perhaps, clinical expertise is not absolute or unfallable. It is constantly subject to doubts, diverging views and negotiations as (Hunter, 1991; Atkinson, 1995:111). Hunter (1991:28) argues that:

“The epistemological importance of narrative – are medicine’s responses to the uncertainty inherent in its predicament as a science of individuals. Because the uncertainties of diagnosis and prognosis are fundamental to medicine, the methods physicians have devised to meet them are a fundamental part of medicine as well”

This implies that an important role of the verbalised knowledge is in the curbing of uncertainty and risk, namely by negotiating:

“We are a kind of oral and assessing profession (...) it is important to have meetings, to discuss which treatment that is most important or correct and whether it should change or not (...) [for chronic patients] we have medications that will not be effective within 3 months or 6 months time” (physician, Dept of Rheumatology)

Hospitals are notoriously hierarchical institutions. This also translates into the issue of legitimising knowledge in the sense that it is highly relevant to know who generates and where knowledge comes from. Bowker, Star and Timmermans (1995), for instance, discuss the challenges involved in legitimising the knowledge of nurses in hospital work.

Knorr-Cetina (1999:131) argues that trust classifies participants in terms of what is known about them, that is whose work can one build upon and who’s results are credible, a point also made by Smith (1990:217) related to trust in textual sources. Thus information is never neutral (Klein & Myers, 1999; Hunter, 1991; Bowker and Star 1999). The credibility of a given piece of data in the patient’s chart, an advice, or diverging diagnosis, is tightly linked to who’s observation or opinion it was (Atkinson, 1995:57). This draws an important distinction between experts and non-experts (Knorr-Cetina 1999:131). This is illustrated by the difference between head physicians as experts and assistant doctors as non-experts. A head physician is assumed to possess high-level competence within the actual special field, while the assistant can possess various degree of competence. This is illustrated when Pasi, the assistant physician in the Dept. of Cardiac and Thoracic Surgery, tells about his head physician’s ‘state-of-the-art’ discharge letters:

”If it is some of the regulars that have produced the summary then I might accept it as ‘face value’ and use it as it is. But if it is produced by an inexperienced physician I have to read more thoroughly to check whether it can be used”

The assistant physicians can be complete novices; some just barely finished medical school or they can have several years of competence from other fields but are complete new to the current one. The implication, regarding the content of the admittance reports, may be as follows:

“Often it is the novices that receives the patients. [Which means] that the assessment can be turned around the following day making the summary worthless”

This aspect of uncertainty fades away as assistant physicians get experience (Atkinson, 1995:111), indicating how trustworthiness has to be acquired not stated.

Trust is not only related to physicians, but also to the secretaries that do the actual writing of the discharge letters as is the case in the Dept of Medicine, section of Nefrology. Only the secretaries in that particular location are trusted to write (based on a physician’s dictating) these reports:

“These patients are special patients (...) [and] the discharge letters must be written by secretaries on the dialyse-section because there it is secretaries that possess the best competence within the problem domain. (...) They are trained in this and the letters are not written anywhere else”

Knowledge about a patient is generated in a distributed manner. This implies that, as part of making sense of a patient, knowledge is validated by involving those ‘closer’ to the origin of the knowledge:

“Based on new information in the process [laboratory reports, x-rays], we discuss the case with pathologists, radiologists and haematologists as well as internally in our department (...) in which the outcome is regularly documented as a note in the patient record”.

The lengthy discharge letter in the Dept. of Oncology reflects the outcome of such a process between the patient, the assistant doctor and the head physician where alternative assessments and treatments are discussed and where they try to make sense of an uncertain case. This relates to the capacity of embracing ambiguity Orr (1990) ascribes to stories. Knowledge thus emerges gradually as a result of a negotiation process.

This revoking of the context of the origin of the knowledge is, of course, not always required. It is necessary whenever the context is not sufficiently well known. There are numerous situations in which this is not necessary as the physician in the Dept of Medicine that decides to use existing information because he knows the context the information was created in as he says:

“I used the summary because I knew the patient and I had dictated the admittance report myself”

or as is the case at the Oncology department when some of the patients are hospitalised for a relatively long time and some of the patients, caused by the treatment protocol must in periods come to the department in order to get radiation treatments or chemotherapy:

“Gradually, we get to know the patients very well and [the nature of the disease] involves them a lot and they must agree on what we decide to do”.

In this way, the patients become regulars and the physicians obtain what Knorr-Cetina (1999) denotes ‘body experience’. This implies that the discharge letters are not only based on accumulated knowledge in the patient record, but also hands-on knowledge about the patients.

Another example is the chief physician at the Dept. of Ear, Nose and Throat when he describes his department and the conditions for systematic and context free reuse of textual knowledge:

”We are a surgical profession with many small and shorter operations where reuse of information has proved very efficient (...) the conditions are of course that the produced documents are brief, concrete and simple”

5.2. Enacting knowledge representations

A relatively downplayed theme in discussions on knowledge work in action is the way knowledge is historically stratified, not in any strict, accumulative fashion but rather as a genealogy of sediments. For a start, this implies that the history needs to be reconstructed and the discharge letters have a key role in this:

The discharge letter is the first document you will look into when establishing an overview of what happened with the patient during hospitalisation. If this is insufficient, you have to look into the running notes and if it still is not enough you have to look into the patient charts in order to check the medications that nonetheless

should be reflected in the discharge letters. Eventually, you have to look into the nurse reports (physician, Section of Nephrology).

This is clearly illustrated when Pasi (Dept. of Cardiac and Thoracic Surgery) dictates the discharge letter which summarises the patient's surgery. Consider how he strategically picks out the one-month old discharge letter from the Dept. of Medicine and how he uses it to improve his knowledge of the case. As the Dept. of Medicine gives the patients full examination prior to their surgery at Dept. of Cardiac and Thoracic Surgery this is hardly surprising. However it illustrates that the discharge letter does not represent purely accumulated knowledge of the case. It rather represents the current sediment in the case trajectory. Going back in these sediments may then prove essential in order to achieve sufficient insight into a case as Pasi explains when describing his initial period as a new assistant physician:

“Most of the time goes to get overview of the whole picture and then I have to read because generally it is difficult to know what is important. It might be that information a while ago is important, that is information that is not summarised in the last discharged letters. In the beginning, sometimes I had to read for 2 hours to get overview of a case”

A key insight is the way repetitions carry weight; they are anything but void. Repetitions selectively enact certain elements by omitting others. The generation of discharge letters, intended to summarise and ‘repeat’ the total stock of knowledge, provides an opportunity to analyse this historical reconstruction of knowledge in action. Garfinkel (1967: 204-205), in his study of medical work, makes a similar point when emphasising the productive roles of repetitions and omittance:

“A subsequent entry may be played off against a former one in such a way that what was known then, now changes complexion. The contents of the folder may jostle each other in bidding to play part in a pending argument. It is an open question whether things said twice are repetitions, or whether the latter has significance, say, of confirming the former. The same hold true of omissions. Indeed, both come to view only in the context of some elected scheme of interpretation”

At the Section of Nephrology this layering is performed during the generation of the discharge letters by enacting – by explicit repetition in the form of textual copying – a particular computational report relevant in the subsequent treatment:

“We have dialyse-patients that come regularly for inspection. And every time it is certain things that must be carried out (...) partly some extremely important computations. (...) Those computations are extremely important because they indicate if it is necessary to change modus and whether the medication is sufficient. (...) We paste the result into the discharge letter”

Yet another example is when the same physician enacts parts of or summarises the x-ray report. From this report, he selects the information what he considers most important as well as making his own assessments.

As a patient spends time in the department, several of the workers get to know the patient through meetings, discussing and assessment of further treatment and informal discussions in the on-duty room. These on-duty rooms are the arenas for collective learning in communities physicians and nurses regularly come and go, questions, discuss cases, share stories and talk on the phone with patients (Brown and Duguid, 1991:46). This transforms individual knowledge into a sort of distributed cognition or a stream of collective self-knowledge recognised by a constant humming with itself about itself (Knorr-Cetina 1999:173). As part of this, there is an ongoing enactment, refinement and omitting of earlier, historical knowledge representations such as the admittance report:

“If the admittance report summary produced in the emergency department is a mix of previous case history and reason for admittance and what the physician believes is the patient’s problem, and then afterwards it appears to be something completely different, then the summary of the admittance report becomes completely useless and wrong, both in professional terms and uninteresting for the discharge letter receiver to know what the admitting physician believed at that situation”

As the physicians have to deal with a lot of uncertainty in stressful situation, sometimes omitting knowledge achieved under such circumstances is hardly surprising. However during the stay the physicians get better overview of the cases which is summarised in the discharge letters. The discharge letters contain not only valuable information aimed at informing the general practitioner about what has happened during the stay. It often contains important information essential for the hospital physicians themselves. This is often the case in departments having a lot of regulars such as the Dept. of Oncology:

“If it is a new patient that will return to the department in order to get radiation treatments or chemotherapy then we are receivers of the discharge letter as well.

Because the physician that admits the patient next time is dependent on the discharge letter in order to get an overview of what has happened earlier and what is thought of in the continuation. Then we often need more details than what is necessary for a general practitioner.”

The enactment of the various knowledge representations that go into the generation of the discharge letters is performed in a fluid, interleaved way; the discharge letters are in-the-making. The situation described from the Dept. of Cardiac and Thoracic surgery is illustrative where Pasi gathers necessary information from the pre-visit meeting, like current status of the patient, change in medications and further treatment strategy, which is fed into the dictating process. As we have seen, he also stops dictating for a moment in order to check other information sources in the investigation room, examines the patient by measuring the talus arm index of the patient. He interrupts his dictating in order to ask the head physician for the patient’s control strategy.

Not only are the discharge letters moulded by the selective omitting and revoking of existing elements of the total body of knowledge, they are also produced with a purpose in mind. They mark the transferral of responsibility from the hospital making the General Practitioners a key recipient group. As a result, the discharge letters, in principle, are generated with a clear sense of what Boland and Tenkasi (1995) describe as perspective taking in mind. A good example of this is the assistant physician in the Dept. of Oncology dictating discharge letters. She underscores that her own ½ year experience as a general practitioner, as a part of their training, has made her aware of what kind of knowledge the general practitioners need:

“The head physicians possess a lot more routines than us, but maybe we [assistant physicians] are more concerned about what the general practitioners thinks and pay more attention to its content (...) [and as a former receiver of discharge letters] I try to imagine what kind of information I would have appreciated”

The conclusion part in the discharge letters is extremely important for general practitioners in their follow-up of the patients. Sometimes, however, discharge letters from high-specialised departments are difficult to understand since head physicians in high-specialised departments typically are more ‘down to the point’ when they dictate:

“There is some discharge letters where it is difficult to know what the conclusion is; whether the patient has as disease or not. And in particular in departments that are very high specialised. A specialist can read more between the lines (...) but to a general

practitioner, it is not clear what the assessment is and how close the patient is in the process towards a diagnose or the current status of the treatment” (GP)

Sense-making is strongly related to the knowledge creators abilities to explain and justify the knowledge. A good example is the lengthy discharge letters in the Dept. of Oncology, like the one whose fragments were presented in the empirical section. The assistant physician underscores that:

“It is important to think about what the general practitioner need to know. We treat new cancer diseases that is not common in general practice and where it is not obvious what to be aware of, like possible side effects of ‘cytotoxin’. And things like that are rather specialised in such a way that it ought to be included in the discharge letter” (assistant physician, Dept. of Oncology)

The point here is that understanding might increase as redundancy or additional information is available (Czarniawska 1997:134). The reader is provided redundant information that might be consulted in the process of getting a better overview. This point comes close to:

‘Learning by intrusion’, which means existence of information that goes beyond the immediate operational requirements of each individual. The redundant information enables individuals to invade each other’s functional boundaries and offer advice or provide new information from different perspectives (Nonaka and Takeuchi 1998: 230).

The final discharge letter then, is a result of continuous collective discussion of the meaning of the case, which also mirrors how knowledge is created. It also illustrates that the discussions is not finished once and for all, but rather it expresses that it in the current situation is not possible to go any further in the investigation.

5.3.Organising knowledge work

Hospitals, as sites of knowledge work, are large, complex and dynamic organisational entities. The complexity has several sources. There is a large number of distinct health professions with associated communities of practice and with different political standing in the hierarchy. The collection of tools, artefacts and equipment is significant. This spans from a variety of utterly mundane artefacts such as report templates and archives to high-tech equipment like MR scanners requiring competent and specialised users. The trajectory of a patient during a stay spawns a comprehensive set of work tasks. The organisation – the coordination,

delegation, tracking and accumulation – of this is not viable through centralised, hierarchical control. The result, then, is that this organising is performed *as part of* the ongoing production of knowledge representations. as Berg (1999:388 following Schmidt and Simone) argues:

“Reading and writing artefacts coordinate activities, then, through a ‘precomputation of task interdependencies’ which ‘reduces the space of possibilities’ for the entities that interrelate with it”

which is conform with Smith (1990:217-218) when she points to that:

“the organised character of formal organisation, depends heavily on textual practices, which co-ordinate, order, provide continuity, monitor, and organise relations between different segments and phases of organisational courses of action”

The discharge letters serves as a coordinating artefact – and most noticeable between the hospital and the general practitioner where it establishes future treatment- and control strategy and who is responsible for what. In order to serve such a purpose, the chief physician in the Dept. of Ear, Nose and Throat emphasises that

“when the discharges letters are concrete and brief they might serve as manageable instructions from the hospital to the general practitioner”

As there might be overlapping responsibilities between the hospital and the general practitioner, establishing who is responsible for what is essential as a general practitioners argues:

”What is very important for us is to have established exact distribution of further responsibility, [that is], what is the responsibility of the hospital and what is the responsibility of the general practitioner”

The discharge letter also coordinates activities between hospitals as is the case when Pasi in the Dept. of Cardiac and Thoracic Surgery has to produce a discharge letter before the patient is allowed to leave. In fact several people in the department are involved in this effort. The discharge letter serves as an instruction for the follow-up procedure in the local hospital. This information is rather important and as one of the secretaries tells:

“There have been instances where the air-ambulance people has refused to take-of as a result of lacking discharge letters”

Prior to his surgery, this patient, as a standard procedure has had a full examination in the Dept. of Medicine. This means that in this department the physicians have evaluated different

treatment strategies and concluded that the conditions for surgery was fulfilled. Thus the baton was handed over to the Dept. of Cardiac and Thoracic Surgery. This occurred among other things through an extensive discharge letter from the Dept. of Medicine.

Yet another example of coordination is the PD-form for dialyse patients shown earlier in figure 1. This form is not merely an externalised knowledge representation of the state of a patient. It simultaneously acts as a vehicle for the delegation and coordination of the required work tasks. The filling in of the cells in the form is delegated across the different professional groups and persons. The degree of completion of the form represents an account of what has been done up till a certain point in time, hence also what remains.

For instance, the PD-form contains instructions to the nurses in the section whom will initiate actions accordingly as is illustrated by the physician reading from the form:

Firstly, here [in the PD-form] it is stated that the patient will be summoned to the next control in the Medical polyclinic, with whom, and 2 months from now. Secondly, New PD-control with PET in May 2002 (...) “The head nurse in the section will get a copy of the discharge letter and will summon the patient to the next control. In the section, they know in any case how to run the standard procedure, but what is special the next time is that they will take specimens from the dialyse-solution in order to perform a PET analysis”

In this way, the PD-form feeds into the work itself and is a part of it or as Berg (1996:9) underscores:

“[The discharge letter] does not merely represent this coordination of work: it stipulates and mediates it. It is a material form of semi-public memory: relieving medical personnel’s burden of organising and keeping track of the work to be done and its outcomes.”

In fact, the PD-form gives a brief and accumulated overview of planned activities for the patient, which according to Berg (1999:391) affords “an increase in complexity of the work practice without a simultaneous increase in complexity in individual interactions”.

Sometimes the discharge letter explicitly may serve as an instruction to the physicians themselves as is clear when the standard procedure in the Section of Nephrology is to read the discharge letter associated with the previous stay (see section 4.3). Often, results from the laboratory often is not ready until the patient has left:

“The PD-patients are hospitalised for 2 days during which some laboratory tests are carried out. However you cannot initiate the medical procedures until the laboratory results are ready [in the meantime the patient has left] and then you have to initiate them next time. Therefore the discharge letters for PD-patient contains a conclusion that instructs what to do in the next round”

6. Conclusions

The knowledge work of physicians in large hospitals display a number of aspects relevant more in general. The dichotomous distinction explicit and tacit knowledge has promoted an oversimplification of how – as part of everyday practice – knowledge is rendered relevant, trustworthy and credible. Similarly, for settings like the one we have studied, the historicity of knowledge is an intrinsic aspect. This implies that knowledge needs to be enacted – repeated, kept vivid at the expense of other – to be relevant for a given purpose at hand (such as writing of discharge letters). The expositions, finally, of pure knowledge work need to be supplemented with an analysis of how externalised knowledge representations, simultaneously, play a pivotal role in the curbing the organisational complexity of coordinating, delegating and monitoring of knowledge work.

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