Formalizing Work – Reallocating Redundancy

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ABSTRACT
This paper reports from an introduction of the electronic patient record for nurses in a Norwegian hospital. In addition to establish electronic written accounts of nurses’ reports, a major aim was to formalize nurses’ work, related to handover conferences. Despite the projects proclaimed success, like reduced overtime, improved quality of the written documentation and eliminated redundancy, our analysis demonstrates an opposite effect. Formalizing the nursing handover and thus reduce redundancy, in fact resulted in a reintroduction of redundancy, although at another time and place. We found that work (and redundancy) in fact had moved, to another time (i), into different artifacts (ii), or old artifacts that now were used/annotated differently (iii).

Categories and Subject Descriptors  
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Documentation, Human Factors, Theory

Keywords  

1. INTRODUCTION
Maintaining continuity of treatment and care within, and across institutional boundaries is a major concern in modern health care institutions. With the nature of health care work increasingly becoming fragmented, specialized and distributed, ensuring a coherent and effective delivery of care is considered to be a major challenge [14]. Important means to deal with this situation have been the formalization of health care work in general, and the electronic patient record (EPR) in particular [6], [42]. The EPR, as well as other similar technologies that aid collaboration and coordination among health care providers, have thus become a significant setting for enquiries in the field of Computer Supported Cooperative Work (CSCW) [4], [8], [10], [12], [18], [20], [39].

In this paper we look at collaboration in the context of the nursing handover conferences, which is an important arena for ensuring continuity of care within hospitals. With nurses being the ones “who weave together the many facets of the [health care] service and create order in a fast flowing and turbulent work environment” [1] (p 279), they are a particularly interesting group to study.

Historically, the ways nurses organize their work and carry out their responsibilities have relied on an oral practice to communicate patients’ conditions across shifts. Informal practices (for instance oral practice and personalized recordings) have been used extensively at the expense of formal, written documentation and specific facts [17], [31]. The lack of formal practice has also implied that nurses have used a large amount of heterogeneous, redundant information sources, that often is referred to as causes of reduced quality and low efficiency [3].

Concretely, we have followed the implementation of an EPR for nurses in the Department of Rheumatology at Trondheim University Hospital in Norway. In addition to establish electronic written accounts of nurses’ reports, a major aim was to formalize nurses’ work, related to handover conferences. A part of this process was to eliminate superfluous information sources and routines.

Despite the proclaimed project success, e.g. reduced overtime, improved quality of the written documentation and eliminated redundancy, our analysis demonstrates an opposite effect. Formalizing the nursing handover and thus reduce redundancy, in fact resulted in a reintroduction of redundancy, although at another time and place. We found that work (and redundancy) in fact had moved, to another time (i), into different artifacts (ii), or old artifacts that now were used/annotated differently (iii). Hence, attempts to formalize by removing unstructured aspects of nurses work, introduced new types of informal elements. More concretely, we proceed along the following dimensions:

Firstly, we explore the role of redundancy in the oral practice in the traditional nursing handover conferences. These conferences...
involve a lot of redundant information, typically when the nurses share information about the patients, and discuss various care strategies. A major motivation with the EPR was to formalize documentation and thus reduce redundant information in the handover process. We aim at having a deeper understanding of the implications of this, thus aligning ourselves with previous research in the CSCW field [10], [12], [32], [39]. Secondly, we focus on how redundancy was hard to eliminate in the implementation process. Indeed, redundancy was not eliminated; it was rather transformed into new artifacts and practices. We explore how. By this, we also extend the debate in the CSCW field that traditionally has focused on how tools support work rather than how a network of people and artifacts may change as a co-construction [4], [12], [18], [40], [42]. Thirdly, and perhaps more disturbingly, lending ourselves to recent achievements in Science and Technology Studies [5], [29] we focus on how initial formalizing efforts in reality reintroduces even more informal work and redundancy, but now largely hidden and disguised. We demonstrate how an informal practice (the initial problem) became part of the solution in order to make the new formal practice work.

The remainder of this paper is organized as follows. First we elaborate further on the theoretical basis for our analysis. We then describe the setting for our empirical investigation and describe the method used followed by a description of the case. Finally we analyze and discuss our findings and draw some implications.

2. THEORY
The nursing handover has received considerable attention in traditional nursing literature and have been identified as crucial to ensure coherence and continuity over the patient trajectory [24], [25]. With the handover predominantly being carried out orally, inefficient completion and its negative effect on the written documentation have been some of its major quandaries [7], [37]. With such a point of departure, we don’t intend to engage in a debate arguing for either oral or written accounts. We just note that traditionally there has been a close relationship between written and oral accounts in the organization of medical work [2]. Therefore, there is no straightforward solution on how much this practice can be formalized and how much should remain oral.

Still we cannot ignore that nursing documentation has gained a lot of international attention lately, especially as hospitals have implemented EPR’s [13], [30]. The same trend can also be observed in Norway [21]. Formalizing nurses’ work is a major aim:

"Written handover may lead to an increased focus on ensuring accurate and thorough nursing documentation and improved utilization of nursing care plans, as these become the primary focus for patient care delivery” [37] (p 42)

As the quote underscores, written documentation and care plans are at the centre of patient care delivery, (apparently) making other information sources and oral practices candidates for removal.

In one way, this idea seems appealing as it may simplify organization, information and work. However, studies in the CSCW field have pointed out that overlapping information sources and redundancies indeed have a role to play. Redundancies are a potential source for reliability in collaborative work [12], [23], [39]. The redundant character of artifacts and information contributes in making components robust since if “one component fails for lack of knowledge, the whole system does not grind to halt” [12] (p 86). In addition, information from different information sources may be compared in order to ensure proper information quality. This important role of artifacts and redundancy imply that people must pay attention to work context well beyond their primary work tasks. An instance of this is typically the handover conferences between nursing shifts.

Research on redundancy has by and large centered on existing work practices and the consequences of eliminating them (see for instance, [10], [12], [23], [32], [39]). This strand of research is conforming to the traditional CSCW literature, emphasizing how people actually conduct their work:

“One of the striking features of the CSCW literature is the way many designers try to respect the ways people actually organize and use information” [27] (p 84)

Another strand of research in the field of Computer Supported Cooperative Work (CSCW) has been on the focus on tools and artifacts to support distributed work. Usually these tools are recognized as being singular or standalone. For example paper-artifacts, shared information displays and monitors [19], shared electronic workspaces [33], non-digital editable large displays [34] or regular off-the-shelf products [15].

While much of the CSCW literature has focused on ‘tools’ and ‘support’, it has to a minor degree focused on how this relationship might induce change, both in the work practice and in the tool itself. [4] (p 385) denotes this as the tool’s transformative potential.

"The mutual activities of tools and staff members are made possible through their interrelation, and, at the very same time, this interrelation affords the emergence of an overall activity that surpasses the individual contributions that both could be discerned to have”

When the tool perspective considers IT more or less independently of the social context [35], it fails to explain the fluid relationship between the social and the technological. Accordingly, we move beyond the traditional support perspective and rather take a co-construction approach, underscoring that the tool and the work-practice shape each other. By this, we emphasize the process rather than the product. The technologies are rather shaped as processes, where the technology (EPR) continuously interacts with work practice as a co-construction.

With that we argue that new tools are not merely technical or neutral devices ready to be put into use. Rather they are constructed or achieved as results of negotiation processes [9], [16], [28]. Acknowledging this perspective, we aim at understanding exactly why and how this co-construction emerges.

Taking into account a co-constructive perspective on the implementation of new technology, we also argue that the traditional view on redundancy must be reconsidered. Traditionally, researchers in the CSCW field have pointed out the consequences of reducing redundancy based in the old work practice. In a co-construction perspective the expressions of redundancy and the artifacts used may also change along similar lines, thus new forms of redundancy may be shaped in the process.
informal are opposites, but still defines each other
informality are two sides of the same coin. That is, the formal and
provide staff with avenues to informally debrief, clarify and
purpose of the handover is to communicate patient information, to
is essential to the continuous provision of quality care. The
communicating patient care could impact negatively on nursing
One can assume that inconsistent methods of determining and
expertise are often involved in the treatment. Importance is
The problems faced by the patients can be multiple and complex,
with the activities of daily living to post-surgery observations,
input to care can vary from very essentials of nursing such as help
ward have many tasks. Rheumatic diseases are chronic conditions
admitted to the inpatient ward both for medical treatment and
spondylarthropathies and connective tissue diseases. Patients are
of 8 days. The medical focus is on chronic inflammatory
hospitals in Norway. The department's in-patient ward has 18
beds and treats 650 patients a year with an average length of stay
by informants for approval and verification of their content.
Regularly during the fieldwork, data has been validated through
representatives from the EPR-vendor.
Observations have been carried out at all hours to cover all
observation sessions documentary material like the Kardex, care
employees. To capture the ‘non-movable’ aspects of nursing (e.g.
formal and informal documents and informal discussions with
introduction of electronic based nurse documentation at the department, looking at the
process of integrating them into the nursing practice. Although he
doesn’t have any formal nursing qualifications, he worked four
weeks as a nursing assistant at the same ward, six months prior to
the launch of the project. The second author has studied the
introduction of electronic patient records at another university
hospital in Norway for several years. The third author is working as a
research nurse at the department. She has been deeply
involved in the introduction of electronic based nursing records
and the formation of the new handover-conference.

3. METHOD
Our study is carried out in the Department of Rheumatology at
Trondheim University Hospital, which is one of the 5 university
hospitals in Norway. The department’s in-patient ward has 18
beds and treats 650 patients a year with an average length of stay
of 8 days. The medical focus is on chronic inflammatory
rheumatic diseases such as inflammatory joint diseases,
spondylarthropathies and connective tissue diseases. Patients are
admitted to the inpatient ward both for medical treatment and
surgery.
The complex need of the patients requires that the nurses need to
master a whole range of skills. Nurses working at the in-patient
ward have many tasks. Rheumatic diseases are chronic conditions
and the nature of the diseases are that patients require different
types of nursing input at different times. Therefore the nursing
input to care can vary from very essentials of nursing such as help
with the activities of daily living to post-surgery observations,
pain management, maintaining tissue viability, patient education,
reviewing symptoms, management of drug regimens,
management of intravenous drug therapy, providing access to
other healthcare givers, and counseling patients who are anxious,
depressed or have psychosocial problems.
The problems faced by the patients can be multiple and complex,
and various health care professionals with different areas of
expertise are often involved in the treatment. Importance is
therefore attached to communication, quality and continuity of
care. Continuity depends on the existence of effective
mechanisms of communication between all health care members,
and in particular the nurses from one shift to the other. Clear and
accurate communication is pivotal to delivering high quality care.
One can assume that inconsistent methods of determining and
communicating patient care could impact negatively on nursing
care. Handover is a commonly used communication medium and
is essential to the continuous provision of quality care. The
purpose of the handover is to communicate patient information, to
provide staff with avenues to informally debrief, clarify and
exchange patient information.

Methodologically this work remains within an interpretive
research tradition [26], [41] focusing on specific technologies in
specific activities. As Chaiklin puts it we "take concrete, meaningful societal practices as a direct object of study" [11] (p .384). We follow a growing body of research that have become to
be known as workplace studies [19], [36], [38], [39]. This
approach is also being applied in numerous information systems
research studies in the health care context [4], [8], [12], [18], [20],
[40].
The first author has been following the introduction of electronic
based nurse documentation at the department, looking at the
process of integrating them into the nursing practice. Although he
doesn’t have any formal nursing qualifications, he worked four
weeks as a nursing assistant at the same ward, six months prior to
the launch of the project. The second author has studied the
introduction of electronic patient records at another university
hospital in Norway for several years. The third author is working as a
research nurse at the department. She has been deeply
involved in the introduction of electronic based nursing records
and the formation of the new handover-conference.

Having spent four weeks working as a nursing assistant, six
months prior to the project, the first author already knew most of
the people working in the department. Consequently he didn’t
have to use too much time explaining his presence and
involvement in the project. He had already gained legitimacy and
become a trusted member of the community, without going native
[22].
The empirical material was collected from November 2004 to
December 2005, primarily by the first, but also by the third
author. Main methods of data collection were an alternation
between participant observation and semi-structured interviews,
techniques well known within the interpretative information
systems research tradition [41]. Collected data include
approximately 450 hours of observation, tape recording of
handovers and meetings, 31 interviews, examination of various
formal and informal documents and informal discussions with
employees. To capture the ‘non-movable’ aspects of nursing (e.g.
paper-based medical record, the chart, smaller notes, nurses
personal notes, etc) a digital camera was used. The first author
also had access to project documentation, emails, etc within the
project.
Observations have been carried out at all hours to cover all
nursing shifts. However, the majority of them have taken place
during the day and the evening shift. In this sense main
handovers, which included both departing and arriving shifts,
have been attended. Handwritten fieldnotes were taken during the
observations and transcribed immediately afterwards. During
observation sessions documentary material like the Kardex, care
plans, running notes, nurses’ personal notes, procedures and task
guidelines, and so on were collected to supplement the
observations.

Interviews were primarily accomplished with nurses working at
the ward, but also with project managers as well as representatives from the EPR-vendor.

Regularly during the fieldwork, data has been validated through
discussion with key informants as well as transcripts being read
by informants for approval and verification of their content.
4. CASE
In the Department of Rheumatology oral communication was extensively used as a way to pass on information between shifts and informal and personalized recordings of work were used at the expense of formal, written documentation. From January 2005 to June 2005 this practice was changed. Written documentation replaced oral interaction and formal records were emphasized at the expense of informal, ad-hoc documents. Below the overall process is described. First we elaborate on the rationale for restructuring the handover, then we describe how it was transformed and finally we present some early results.

4.1 Relevance and Low Quality
Initially, the nurses had identified two problems with the handover conferences. Firstly, the conferences were considered to be lengthy and inefficient. Irrelevant, at times speculative information as well as data formally documented in the official record was communicated. Meaning sometimes the nurses just spent too much time talking about patients. Other times they just weren’t synchronized, in the sense that they didn’t have any prearranged agreement on ‘who should report next’. Hence the oncoming shift was at times left alone waiting for the next nurse to show up. This lack of structure often brought about overtime and frustration among the nurses.

Secondly, it was a quality issue. Information was not properly documented in the right places. Some of the EPR-documents, like the nursing care plan, were hardly used while others where used beyond their application area. It was common practice to duplicate information. For instance, information that was mainly to be recorded in the patient chart was also recorded in the written report, the patient list, various observation forms, etc. This was considered a major source of error, and failing to comply with their commitment to creating a coherent and effective health care service. More specifically, the written reports was said to contain too much redundant and irrelevant information. For patients being admitted for longer periods, the reports became rather extensive, making it difficult to get an overview of the patient case.

To illustrate the problems encountered by the nurses, now we provide an example of the handover conference as it was carried out prior to the project.

The old handover conference took place in a small room called the interviewing room. Two couches encircling a small table and a TV placed in one corner made the room usable for various purposes. For instance, both patients and staff used it for social purposes. Three o’clock in the afternoon, the oncoming shift had seated themselves in the adjacent couches. By now the leaving shift was finished writing the report and ready to hand over tasks and responsibilities. One after another nurses from the leaving shift turned up, each carrying a binder for their admitted patient and a patient list. The binder contained formal documents to be kept aside for the paper-based patient record. The list on the other hand was an overview of all admitted patients arranged after which room they were lying in. It contained extracted information about diagnosis, treatment and other things relevant for the care provided by the nurses. Its usage, however, was limited to a certain work-shift as it was marked for destruction at the end of every shift.

The brief itself took form as a story. Structured by the patient list, told by the reporting nurse and commonly commented on by one or more nurses from the oncoming shift. All patients on the ward were reported on while oncoming nurses listened and took personal notes on their own blank patient list. We enter the scene as Anne, an experienced nurse, is about to hand over information on a patient. The patient is well known among the nurses as he has been committed to the ward several times earlier. While talking, Anne lends herself to the patient list.

Anne: room 610-4: doctor Petersen from the Dept. of Orthopedics have looked at the foot (…) He has to discuss with other physicians at the ward what to do with the patient
Evening shift nurse Jon: Was it the toe?
Anne: Yes
Evening shift nurse Jon: But Doctor Larsen has looked at that toe earlier
Anne: Yes, but doctor Petersen wanted to discuss it with his ‘mates’ in our ward [physicians working at the rheumatology ward]… so they are discussing and discussing, and I think that’s the only remaining issue on this patient.
Evening shift nurse Lise: Does that mean that the patient does not have the old diagnosis?
Evening shift nurse Olav: No, it only means that she has an abscess on/in the toe
Anne: Yes, that’s right.

This type of interaction was very common and often there were long discussions around difficult patient cases. Even though Anne didn’t use the written report while briefing, it had been updated prior to the brief.

This day, as often happened, the overall brief exceeded the standard half hour. A couple of times the oncoming shift was even left alone waiting for next reporting nurse to show up, hence the clock was almost 15.50 before the last reporting nurse had completed her brief.

Afterwards the oncoming shift gathered in the meeting room. By means of a large whiteboard admitted patients were divided between the nurses. More often than not, the allocation of patients among the nurses was negotiated. Sometimes due to the rotation scheme, as neither the primary nor the secondary nurses were on duty. Other times because some patients were more demanding than others, making it important to distribute them evenly among the nurses. Afterwards, collective tasks were assigned to individual nurses; for instance tasks like printing out the X-ray program, delivering blood-samples, preparing coffee for the patients, and so on.

Throughout the process different artifacts and people came into play. The report which was written prior to the handover conference; the patient list which had been used throughout the watch, but became crucial at moments of coordination; the nurses; the whiteboard; the discussions around patients, etc. Hence, the accomplishment of the handover was not reducible to the reporting nurse alone. It was rather an accomplishment of a network of people and bits and pieces of information heterogeneously distributed in time and place. Elements of information were found in the binder, the patient list and information provided by the oncoming nurses as well as the reporting nurse.
For the purpose of the handover, among the most important documents were the written report (updated at the end of each shift) and the patient list.

A common feature in all documents, formal as well as informal, was their embedded redundancy. Take for instance the written report found in the binder:

The patient is disoriented. She is weak, and most of the day she has been sleeping in a chair in the living room. Her daughter has been here today with new clothes. She thought that her mother’s condition has deteriorated. (p5) Patient is referred to a CT scanning of the pelvic tomorrow at 14.00. Fast from 10.00 and drink gastrografin [contrast fluid] from 12.00. Blood samples have been ordered on Monday. Analgesic has been increased to 1gx4. Observe effect during this weekend. Nurse P. Olsen

A lot of this information was also documented elsewhere. Information about the CT scanning could be found in the X-ray program and analgesics in the patient chart. Some parts of the content were also mentioned in previous reports while other parts were indications of future activities. For instance, remarks about the patients’ disorientation were mentioned several places in previous written reports and the comment about gastrografin was also mentioned a report the next day.

The redundancy involved in both the oral practice of the handover and in the written documentation was considered a considerable problem:

“… In my opinion, what’s dangerous about the oral report is that too much emphasis is put on what people believe and think. E.g. ‘I think… my patient seems depressed and miserable…his wife did not turn up yesterday’ and all that. Too much talk not relevant for the situation. Maybe more important are things like ‘the wound was red yesterday’ and ‘that pain heating medication does not seem to help the patient’ and ‘the patient has to be turned to avoid blisters on the heel’… things that are a bit more concrete. This is something we feel has been overshadowed earlier. That is the content hasn’t been good enough when communicated orally. To a large degree the report has been too dependent on the person giving the report” (Head Nurse).

### 4.2 The decision and the solution

Changing the handover conference was closely connected to the expectations related to the concurrent implementation of the electronic based nursing documentation module in the EPR. From the outset, nursing managers in particular, underlined the close connection between the two projects. As expressed by the Tutoring nurse during an interview:

“My hope for the EPR is that we become better in stating problems, interventions and evaluation [main elements in the theoretical nursing process]. This will help us systematize and improve our thoughts, and is also necessary due to the increased requirements put on written documentation.” (Tutoring nurse)

As the EPR should become the standard documentation tool at the hospital, new requirements related to documentation was something the nurses had to comply to. Emphasizing the written accounts in the handover conference was thus a strategy to prepare for the future usage of the EPR.

Gradually oral accounts were going to be replaced by written accounts and paper-based technologies by electronic based technologies. The overall change is illustrated more explicitly in figure 2 below.

A pilot study was carried out to look into how the oral handover could be improved. The recommendation from the pilot study was to restructure the handover conference by establishing a combination of a written and an oral brief. Oncoming nurses were now supposed to start by reading the written documentation and afterwards confer orally with the reporting nurse issues that needed to be clarified.

The change was carried out on two phases. First the handover was changed from oral to written in January 2005. Second, in June 2005, electronic based reports replaced the paper-based report. The report itself was supposed to be written into and read from the EPR. This new practice is described in more detail in the next chapter.

### 4.3 The new written handover practice

The new handover conference was partly carried out in the nurse’s office and partly in departments meeting room. It started at 3 o’clock in the afternoon. By then the leaving shift had already finished writing the report in the EPR and put the binder back into the shelves in the meeting room. The binders had become rather thin, as most of the paper based nursing documentation had been replaced by forms found in the EPR. The oncoming nurses arrived...
in the meeting room. Here they checked the distribution of
patients that already had been allocated by nurses on the day shift
and recorded on a whiteboard in the meeting room, picked up the
correct binders and went into the nurses’ office to read the
documentation.

With most of the nursing documents integrated in the EPR,
making it inaccessible while working in the ward, the patient list
was typically used to record things to remember and tasks to carry
out during the watch. In addition ambiguous issues and questions
were written down in order to remember them when conferring
with the leaving nurse later on.

Let’s take a closer look at this process. We follow Tom, one of
the older nurses in the ward. We enter the scene as he is about to
start reading on patients that he has been assigned. Tom has
seated himself behind one of the computers in the nurses’ office.
The room is strikingly silent, even though several other nurses are
present. With their back turned against the middle of the room, all
nurses are deeply concentrated on reading the report. Tom picks
up the patient list before opening the EPR. The list helps him
remember which patients he has been allocated and thus which
patients to search for in the EPR. The first patient has recently
undergone a surgery. Tom opens the last report which is dated
13/8 (yesterday). Although a lot of older reports are also available
on the screen, Tom only read the last report. I ask why, and he
answers:

“Well it all depends you know. How complex the patient
case is. This patient [patient recently undergone a surgery] for
instance is rather easy as it more or less is defined in the
post-operative procedure what to do. However in other
cases things might be more difficult, and then I often go
backwards. For instance if the last note indicate that there
have been frequent changes in patients condition I usually
read backwards to get a better understanding.” (Nurse Tom)

Tom continues his reading. From time to time he makes a note on
the patient list, which is lying on the table in front of him. Having
read on all patients, he returns to the departments meeting room
where the nurses from the leaving shift are waiting to give
additional information and clear up ambiguities. Tom only talks
to nurses that have had the same patients during the day shift.
With several simultaneous discussions going on in the room the
overall setting appear rather noisy and hectic. While discussing
with the first nurse, Tom picks up the patient chart to check the
medication. As opposed to the old oral handover, which took
place in the smaller meeting room, the patient chart is now
available during the brief. It is lying on the conference table in the
middle of the room. In fact several nurses use it during the
discussions. Also used by several are the patient lists. Not having
direct access to the electronic based nurse documentation, the list
is commonly used as a reference point during discussions. As is
the whiteboard holding information about the allocation of
patients.

Officially, around 15.30, all nurses from the day shift should have
left the room. However, today three of them are still present. They
have all waited patiently for the last coming nurse to be
available so that they can have the official discussion. In fact
the last reporting nurse doesn’t leave before 15.40 after having
waited almost ten minutes on another nurse to finish talking with
the same oncoming nurse.

When the day-shift has left the room, Tom asks every nurse from
the oncoming shift to stay put for a couple of minutes. They all
gather around the table and provide an oral brief on all admitted
patients. This is in fact not a formal part of the handover
conference, but initiated by the nurses themselves as they all
prefer to have a certain overview of all admitted patients.
Structured by the patient list, an account is given for all admitted
patients by the various responsible nurses’. E.g. Tom gives a short
brief the patients that he has been assigned. Again the list is used
for taking notes. Yet during this session some nurses have to leave
the room to attend patients that have called them up. Around
16.00 all patients on the list have been reported on. It doesn’t take
long before the room is emptied and the nurses have started to
carry out tasks and responsibilities.

As for the oral handover, in the new written handover various
artifacts came into play during the overall process, making the
heterogeneity in producing an account even more visible than
before. For instance the patient chart and the whiteboard, which
were both used extensively during the oral discussion that took
place afterwards.

A last interesting observation was the establishment of the weekly
summary. Having to handle information that increasingly became
more distributed, the nurses felt a need to summarize the
information at regular intervals. First of all to make the record
easily accessible for nurses that hadn’t been on duty for a while.
Second, as a marker where important decisions and observations
were highlighted.

“The weekly summary has actually become a necessity
because we loose the general view when having to work
with so many different documents… for instance the patient
chart, various observation forms, care plans, etc.” (nurse)

Today, about one year after its introduction, the nurses have
agreed to continue handing over information by means of the new
written method. As described in the next chapter, according to an
internal evaluation, the project was a success.
4.4 Early results
As a part of an internal evaluation, organized by the nurses themselves, time spent on the overall handover was measured over a one-week period prior to and after the change. In addition the nurses completed a questionnaire where one of the questions was to self-report time spent on the nursing documentation throughout the shift. Results from these assessments are illustrated in the tables below.

Table 1: Average time spent using the nurse documentation throughout the watch (in minutes)

<table>
<thead>
<tr>
<th></th>
<th>Sept. '04</th>
<th>May '05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day-shift</td>
<td>20</td>
<td>35</td>
</tr>
<tr>
<td>Evening-shift</td>
<td>17</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 2: Average time spent on the entire handover (in minutes)

<table>
<thead>
<tr>
<th></th>
<th>Sept. '04</th>
<th>May '05</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handover - afternoon</td>
<td>41</td>
<td>25</td>
</tr>
</tbody>
</table>

Time spent on the handover was noticeably reduced. Also overtime was reduced:

“Overtime has decreased significantly” (head nurse)

Figures derived from the questionnaire suggest that the emphasis on the written documentation had increased for the day-shift, but more or less stayed the same for the night shift (see table above). With most of the work being carried out during day-time these figures were not unexpected. In addition, the number of nursing staff was highest during the day. Hence each nurse had fewer patients to handle and more colleagues available to assist if needed. Another interpretation of the figures is that the overall process, both the handover project and the ongoing introduction of the EPR, had made the nurses more attentive to the written documentation in general. They had become more structured in documenting their work. For instance they had become better in updating and using the paper based patient chart, care plans are used more then before and the written reports have become better structured. Since the day-shift knew that the next shift wouldn’t get an oral brief, they made sure to put an extra effort in making their written accounts as readable as possible. In particular this was observable for the patient chart, observation forms, and the like. As stated by one of the nurses working night shift:

“I am impressed how people have improved in updating the patient chart. That simplifies our tidying job a lot” (nurse)

All in all, the figures confirmed that initial objectives were reached (as also partially declared by the nurses themselves). Still the everyday, practical implications of having to follow a new handover and documentation regime could not be derived solely from the numbers in the tables above. This will be further discussed in the next section.

5. DISCUSSION
The discussion is organized as follows. Firstly, we elaborate on redundancy in the oral practice, how it contributes to overview, sensemaking and agreements. In that way, redundancy enabled robust and effective work. Secondly, we present how the reallocation of the use of artifacts actually became a stabilizing mechanism. Thirdly, we illustrate how the initial objective of reducing the informal practices, quite surprisingly, reintroduced those very same practices.

5.1 Redundancy and oral practices
Written documentation has a clear and often more narrow purpose compared to oral accounts. For the nursing profession striving for quality and efficiency through written accounts, this is a dilemma. A lot of important information provided orally in the meetings, is typically ignored in the written accounts, and nurses continuously rely on this information. They often need to understand the whole person to be able to make reasonable judgments on proper care. An example may be related to psychosocial conditions: to understand why a patient behaves the way he does:

“A patient on the ward has a problem with drugs. In such cases the medicine room is locked at all times and medicine to the patients is locked in there as well and we have one-to-one follow-up on patients that uses medication.” (nurse)

The majority of the nurses mentioned the importance of sharing similar (redundant) information about all patients. It was considered a safety issue, as it was crucial that all nurses involved had an accurate understanding of the patient in case of emergency situations

“Not having an overview implies that we are not as prepared as we should be in cases of emergency… that’s not acceptable.” (nurse)

Moreover, providing an encouraging atmosphere for patients was also considered to be important. Although environmental therapy is not explicitly visible as a treatment effort, nurses working in this ward inherently strove to obtain sufficient knowledge about all patients as it was considered a fate of good manners.

“It’s nothing more than polite to be able to recognize patients. Look here for instance, I have written crutches behind this patients’ name [in the patient list]. In that way I can recognize her when I meet her” (nurse)

“A patient has digestive trouble, and I have noted this down so that I know when I meet him that I don’t provoke by offering food.” (nurse)

An interesting aspect of the oral accounts was that it enabled the possibility of including redundant information on the spot. This flexibility enabled the nurse handing over information to decide what should be communicated during the report. He or she could tailor the oral report according the personal preferences, knowledge and experience of the receiving nurse:

“You know, having the experience from a shift, the reporting nurse should be autonomous in deciding how and what should be conveyed during a brief, as she is the one that has revised plans, recorded observations and has the best knowledge about recent changes in the patient status” (nurse)

What’s more, some nurses valued the oral handover because it facilitated a kind of ‘debrief’ about their activities during the shift.

“I think the oral report is important because it is a way to reflect on what has happened during this shift and to prepare
the next nurse on what to expect during the next one. In this sense the report is useful both for the reporting nurse as well as for the nurse oncoming her shift.” (Nurse)

Seemingly similar and redundant information was compared, made sense of and negotiated. Due to the contingent nature of nursing, measures and observations were regularly discussed. With patients suffering from a chronic disorder, nurses usually got to know the patients quite well. Hence, when the reporting nurse was carrying out her report, nurses starting their shift usually knew about the patient being reported on and actively took part in the story presented by the reporting nurse. As one nurse puts it:

“Maybe the best thing with the oral report is that it enables a feedback and discussions around observations and measures where I am uncertain. For instance, if I am uncertain about how to interpret my observations I can discuss it with the nurses who start their shift. Actually… because of the rotation scheme many of them have been working the day before and therefore know the status of different patients quite well… Sometimes I even avoid putting things into the written report because I am not sure if my observations are correct… better to just make sure that nurses in the next shift observe the same thing” (nurse)

5.2 Reallocation of work – from one CSCW tool to a network of artifacts

The transformation changed the ‘handover’-network dramatically from a coherent story presented by the reporting nurse towards a story made by nurses reading information fragmented and distributed among different people and artifacts constituting the patient record. Although many nurses to some extent felt lost during the implementation process, one year after its introduction, the new handover practice was maintained. However, new mechanisms have gradually been introduced to cope with the new practice.

The implementation and improvement of the written documentation was partly motivated by a need to avoid duplication by making sure that information was recorded in proper places. As described above, in the old paper based-practice, duplicates were often found in various documents. For instance information supposed to be recorded in the patient chart was written in the patient list. Similarly, information supposed to be recorded in care plans was instead embedded in the written report, and so on. On the one hand, changing the handover and introducing the EPR actually enhanced nurses written accounts. On the other hand the process of recording and reading became even more heterogeneous than before as the nurses now had to deal with a multitude of additional information sources. Examples of this includes; the nursing care plan as mentioned above; a more extensive usage of the patient chart; and the establishment of the weekly summary (as will be described more closely below). This change was further enforced by the fact that now the nurses ‘moved around’ during the handover conference (e.g. from the nurses office to the meeting room) and thus had easier access to a variety of supplementary artifacts (like the patient chart).

Another interesting observation was the establishment of the weekly summary, written every Thursday on patients that had been admitted to the ward for longer periods. With information increasingly becoming more distributed, the nurses felt a need to summarize the information at regular intervals. First of all to make the record easily accessible to nurses that hadn’t been on duty for a while. Secondly as a marker to highlight important decisions and observations that otherwise could get lost.

“The weekly summary has actually become a necessity because we loose the general view by having to work with so many different documents… for instance the patient chart, various observation forms, care plans, etc.” (nurse)

The weekly summary was in essence a way to maintain an overview on how the individual patient level progressed. Thus the main reason for the weekly summary was that it was needed as a compensation for the old oral accounts in the meetings.

5.3 Reintroducing the informal in order to cope with the formal

The established formal practice, initially considered to be the solution to the informal practice problem, now appeared to nurture the original problem. It is our observation that the efforts to establish a formal practice through nursing documentation have been self-defeating. Below we provide three examples to support our argument: (i) informal pre-allocation of patients, (ii) re-introducing of the oral report, (iii) increased dependence on the informal patient list.

The procedure of allocating patients to the nurses illustrates how an informal practice was used to support a formal practice. The formal principle was that primary and/or secondary nurses should be assigned their own patients and resource-demanding care patients should be distributed evenly. This was far from a straightforward task as they sometimes were off duty. This made the distribution of patients an open question and some patients were more preferable than others:

“Sometimes we would like to be responsible for specific patients. Either because we know them well or because a substitute or an enrolled nurse, not listed in the official record [nurse binder], previously have had the responsibility for the patient.” (nurse)

The new practice of allocating patients was dramatically different compared to the old one. The upcoming shift of evening nurses had been ‘deprived’ the opportunity to informally negotiate on the distribution of patients. Therefore, another informal practice was established. The nurses showed up earlier than required in order to make sure to get the patients they wanted:

“Some nurses show up earlier than required and redistributed patients according to their own needs. Immediately afterwards they started to read on their own patients. Thus, nurses showing up later had no influence on the redistribution of patients and had to cope with the leftover.” (Nurse in retrospect)

Another mechanism reintroduced due to a lack of overview was the oral report. Immediately after the day-watch had left the ward, the evening watch sat down in the meeting room and gave a short brief on all patients:

“Now, the day shift nurses leave even earlier than before, however the evening shift often aren’t finished by then. Sometimes we [the evening shift] sit as long as until four o’clock and discuss patients before we actually start working in the ward” (Nurse)
An important dimension lacking in the new handover process was the questions and comments from the other nurses on the oncoming shift, which both supplemented and improved the overall report. In addition the ‘reintroduced’ oral report was crucial for the cooperation and coordination of work taking place around specific patient groups, as it made available important information to the rest of the nurses (e.g. in cases of emergency)

Our last example illustrates how an easy access to the various formal documents made the nurses rely even more on the ‘informal’ parts of the documentation. The patient list, primarily used as a temporary record, had now become even more important than before. It was, among other things, typically used to keep an overview over all admitted patients:

“The patient list has actually become even more important in the report because we no longer have direct access to the nursing record during the handover [last part of the new handover)” (nurse).

Having copied important information from the electronic based nursing documentation to the list, it was actually the only reference point to be used during the discussions that took place in the meeting room. In this sense, some of the work previously performed based on information found in the binder was now carried out based on information in the list. More generally the adaptability and flexibility of the list facilitated a smooth working process, as it was neither too strictly limited to certain aspects of work, nor did it limit the way work was carried out. It seemed to be very important for preserving a collective ‘working’ memory. At the same time it was valued as a practical working tool, as it allowed the nurses to make provisional notes and comments while working (in situ).

The informal practice, as illustrated by the informal pre-allocation of patients, the reintroduced oral report as well as the increased dependence on the informal patient list, had become a part of the solution in order to make the new formal practice work.

6. CONCLUSION
In this paper we have looked the transformation of the handover conference in the context of the introduction of electronic based nurse documentation. In particular we have looked at the notion of redundancy during the overall change. Our analysis has revealed that attempts to reduce redundancy in fact resulted in its reintroduction, however now at another time and place. We found that work (and redundancy) in fact had moved, to another time (i), into different artifacts (ii), or old artifacts that now were used/annotated differently (iii). Moreover we have demonstrated how informal routines in the handover conference, which initially were considered a problem, became part of the solution in order to make the new formalized handover conference work.

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8. REFERENCES
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