A case study of nurses information and communication needs

Anders Mannerhagen
andma440
8503127253

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Abstract
The role of information technology within health care is getting more central and prominent. The purpose of this change is both to make the health care more efficient and to heighten patient safety. This exploratory case study of four care units aims to provide a glimpse into the clinical work of nurses, and to identify and describe their communication and information needs. The analytical framework used in this study is distributed cognition and the research method used is cognitive ethnography. The study provides a peek into the complex system of health care, and how the central artifacts such as patient records, whiteboards and different alarm systems are used in this context. The result of the study describes the current work practices and information flows in the studied care units. From these results general system design implications are made.
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Preface
This explorative case study was performed in cooperation with Ascom Wireless solutions. With the purpose of exploring today’s practices and the need for new technology in the health care setting. The focus of this report is however is to generally describe how the environment and needs of the nursing staff. The more direct and tangible design implications in relation to the company’s products are written in another report to Ascom.

I would like to thank my supervisor from Linköping University Nils Dahlbäck and Karin Eklund from Ascom for all the help I’ve received during my work with this study. I would also like to thank Bodil Axelsson and Lars Uhlin for their valuable contributions to the study.

I would also like to thank all the helpful nurses, assistant nurses and doctors at the heart centre for being so helpful and making this study possible. There are some people in the care units that have played more central roles. Whose names cannot be recounted here if the anonymity of the hospital is to be preserved, whom I would like to thank specially.
1 Introduction

In the spring of 2009 early one morning I was on my way to the regional hospital to start my fieldwork for this study. In my previous experiences going to a hospital has hardly ever been affiliated with something positive. The setting of a hospital environment felt to me as an outsider like some kind of ordered chaos with all the alarms and people in white clothes moving around. The design of the rooms and hallways gave me the impression of being in a sterilized and alien environment. This feeling became reinforced by the smell of cleaning agent. All the hallways looked to me as the ones I just had passed, and the only way I was able to find my way was by looking at signs hung under the ceiling and asking for directions to the office of the administrator.

These were my initial impression as I came in to the hospital setting the first morning. After spending 40 hours in the different care units, getting to know my way around and some of the people there, I cannot identify with the description above any longer. The feelings are now replaced with a sense of security and trust towards the nursing staff. The health care setting is a high paced mission critical environment where professionals every day as part of their work deals with and care for patients in a stressful and sometimes frightening part of their lives.

A trend in health care today is the introduction of information technology. The introduction of this new technology is not always connected to actual needs of the healthcare professionals. The rapid technological development is forcing new products upon the professionals and changing how the work is performed. New technology is developed, sold and distributed to the end-users often without understanding the way professionals work, and how this new technology will affect the working routine. The technology used in health care units are developed, tested and sold, but nobody has thought about how all the different systems are going to integrate or coexist. In most places multiple alarm system are active at the same time, creating a stressful work environment for the staff.

1.1 Purpose

The purpose of this explorative case study is to describe the information and communication between health care professionals at a Swedish regional hospital. This was done by taking an explorative ethnographic approach and by studying cooperation and the use of central artifacts. The goal is to provide some insight
and describe how nurses collect, use and distribute information relevant to the
clinical work setting. This means combining both user- and process centered
descriptions. The theories described in the theoretical background should be
regarded as filters or “work tools” for the author’s understanding and description
of the work in the units.

1.2 Delimitations
This case study focuses primarily on communication and information needs of
nurses in a care unit at a regional hospital. The surroundings play a key-role in
the complex system that is health care, and can therefore not be entirely excluded
from the study. Most part of the nurses’ work involves communicating with
patients, relatives to the patients, doctors, assistant nurses, and other nurses.

1.3 Overview
Chapter 2 – Introduces the theoretical background used in this study, and
provides the reader with the theories that were used for analysis. These are;
distributed cognition, aspects of artifacts, metacognition, and the role of spatial
ordering and how memory is looked upon within distributed cognition.

Chapter 3 – Presents the method of cognitive ethnography that was used to
gather information and how it was applied in this study.

Chapter 4 – This section presents the ethnographical data from the field study.

Chapter 5 – The identified communication and information needs are discussed
and design implications are extracted from the ethnographical descriptions.

Chapter 6 – Contains some design deliberations for this context, some of the
authors own ideas and reflections are presented and some final conclusions are
presented.

1.4 My background and effects of the used framework
The scientific schooling within this branch of cognitive science emphasizes the
importance of artifact use and cooperation between agents. This view promotes
the view of agents performing tasks with the use of artifacts as opposed to seeing
humans walking around and doing their job. This is an effect of the focus on
artifacts that’s used in the distributed cognition paradigm. This approach proved
to beneficial in the hospital setting since the description is focused on the task
and the function performed by the staff or patient, rather than describing
everything that the individuals say and do.
2 Theoretical background

Introduces the theoretical background used in this study, and provides the reader with the theories that were used for analysis.

2.1 Distributed cognition

The book "Cognition in the wild" (Hutchins, 1995) proposed an alternative way of looking at cognition, not as confined to an individual but as a distributed phenomena that occurs in a context. He considered that the traditional way to study cognition in a controlled “lab setting” did not show the whole picture, and proposed an alternative more pragmatic framework that would complement the lab results. This framework was called distributed cognition, and views cognition as a process that can be distributed over; members of a social group, artifacts and environment and also over time (Hollan, et al., 2000). The focus is on how information changes when its transferred between humans and artifacts. It is according to this view not meaningful to refer to cognition as something that is isolated inside a single individual. Within this framework the interest for individual mind is maintained but also adds the material and social constructions of action and meaning (Hollan, et al., 2000).

2.1.1 Distributed cognition in the health care setting

Distributed cognition has also been frequently used to describe cooperation, artifact use and communication in the context of health care before (Broome & Adams, 2005; Bång & Timpka, 2003; Hazlehurst, et al., 2008; Hollan, et al., 2000; Nemeth, et al., 2006; Nemeth, et al., 2004; Wilson, et al., 2007; Xiao, 2005; Xiao, et al., 2007).

Hazlehurst, et al. (2008) uses the framework to describe how a system consisting of actors, tools and rules cooperate in activities oriented towards a goal. They exemplify this by describing how a system consisting of a blood pressure measuring device and a nurse (who has general medical knowledge, knowledge about the patient’s condition and how these are connected to the patients medication) who’s using it can cooperate to monitor a patients’ blood pressure. This information can then be transferred to other health professionals by a communicative medium and thus creating “an image over the patient’s medical status over time” (Hazlehurst, et al., 2008).

“The distributed cognition model provides a lens to understand the importance of visual representation in collaborative work. Visual representations can provide memory aids and can provide directly perceivable information (such as constraints and options), as demonstrated in laboratory experiments.”(Xiao, et al., 2007).
Tang and Carpendale (2007) and Wilson et al. (2007) both use the involved artifacts to describe how information flows during a shift change. Tang and Carpendale (2007) uses the terms personal information space (PIS) and common information space (CIS). A personal information space like personal notes or reminders, are only used by one person and the need for standardization is therefore not that high. Common information space like whiteboards or patient records on the other hand has many users. This increases the need for standardization of content and structure to avoid misunderstandings. They note that the customization of textual content, information coding and spatial positioning of information in PIS is the main reason for using them (Tang & Carpendale, 2007).

2.2 Artifacts
Hutchins (1999) defines cognitive artifacts as physical objects that are used by humans for the purpose of aiding, enhancing or improving cognition. He argues that it’s not the structural properties that makes an artifact cognitive or not, but how the artifact is used. Hutchins notes that by using a calculator to do an arithmetic problem, his mathematical skill does not improve but the functional system of him and the calculator performs better. Normans (1993) view of artifacts also includes mental objects as rules of thumb and memorized procedures. He argues that by making a checklist or note we externalize information from our memory, which changes the task from recall to recognition.

2.2.1 Affordance
Affordance is a term that Norman uses to describe a quality of an object or an environment that allows an individual to perform an action. He exemplifies affordance with when we see a chair we become “aware of” how we can interact with it (Norman, 1993). Kirsh (2004) describes a well designed artifact as something that guides the user by showing him how it can be used, and hiding the aspects that shouldn’t be used, i.e. showing and hiding affordances.

2.2.2 Whiteboards in health care
Whiteboards are communicative artifacts that are extensively used in health care context and have thereby become the subject for several studies (Broome & Adams, 2005; Riley, et al., 2007; Wong, et al., 2009; Xiao, et al., 2007). The study made by Wong, et al. (2009) showed that the introduction of an “computerized whiteboard” can lead to improvements for the staff, but also stresses that the success of the system depends on both the involvement of end-users in the development phase and getting user input on the displayed information (Wong, et al., 2009).
Xiao, et al. (2007) also concludes that flexibility and tailorability are extremely important aspects of a “computerized whiteboard”. Furthermore they found 8 different ways in which the whiteboard influenced the work and supported collaborative work.

“... task management, team attention management, task status tracking, task articulation, resource planning and tracking, synchronous and asynchronous communication, multidisciplinary problem solving and negotiation, and socialization and team building”. (Xiao, et al., 2007)

2.2.3 “Openness” of artifacts
Garbis (2002) showed in his study how the same artifacts can support the sharing of information differently, depending on the performed task. He calls this quality of artifact usage for “the level of openness”. This is in essence how well the interaction with the artifact is visible to other people in the vicinity. He concludes from the findings in this study that; different artifacts have a different degree of information sharing, and the degree of openness is not exclusively dependent on the design of the artifact but also on how it’s used in a specific context. He also shows that users creates or modify their tools for the situation where the artifacts are used.

2.2.4 Physical aspects of artifacts in health care
The health care setting is compared to an ordinary office a much more physically rich environment where almost all tasks involves some form of cooperation between people. Despite of this ordinary computers (designed for “the paperless office”) gets forced into this environment and removing the physical aspects of the artifacts (Xiao, 2005). Another study that emphasizes the physical role of artifacts in the healthcare setting concludes that physical aspects of the artifacts “...are used by clinicians in different ways to form cognitive tools that offload memory tasks and support joint attention and collaboration.” (Bång & Timpka, 2003)

2.3 Metacognition
Metacognition is “thinking about thinking” and is associated with planning, monitoring, evaluating, repairing and enhancing ones performance (Krish, 2004). These processes are according to Kirsh often supported by external physical objects, such as a clock or checklist that help us track where we are in an activity (how long time we spent on a task, or what tasks are remaining). In the article he discusses that “the right design” of an object supports metacognition and it’s up to the designers to make sure that the artifacts and surroundings guides and supports the users in their tasks.
2.4 **Capacity and performance**
Hollnagel and Woods (2005) argue in accordance with “the law of stretched systems” that the constant increase on performance demands and the potential of technology creates a self-reinforcing circle that pushes the performance of the system to its limit. They claim that by introducing new technology and adding functionality to a system the demands on the user increases with the heightened production potential. This once again pushes the system to its production limit, even if there are isolated improvements. This development with more complex systems and higher production demands will accordingly to the authors lead to an increased task and system complexity. This in turn means more opportunities for malfunctions, and more opportunities will lead to more accidents.

2.5 **Spatial ordering**
Space is according to Kirsh (1995) a “resource” like time, memory and energy, and as such it needs to be used in a cost-efficient way. He argues that we humans not only modify our surroundings but also that we create our surroundings to support us with our tasks. He makes a distinction between using the space around us as constraints that restrain us from performing an action, and as cues that calls attention and reminds us of a task that needs to be carried out, this he calls “to jig ones environment”. Restrictions can be physical (as a doorstop) or it can hide affordances (i.e. choices) from the user, and cues is structuring ones surroundings to bring forth desirable affordances. By arranging our environment we unburden our memory and shorten both visual searches and searches “within our memory” (Kirsh, 1995). Kirsch (2004) discusses how this can be done with a text using headlines, sections, colors and so on.

2.6 **Memory**
Within distributed cognition framework the term memory has a different meaning than the classical individualistic and pure mental view from psychology, according to this view memory can (as cognition) be distributed between people and artifacts (Hollan, et al., 2000; E Hutchins, 1995). This does not mean that terms such as short-term, long-term and working memory are disregarded. For more information about classical theories of memory see (Sternberg, 2008).
3 Method
In this section the method of cognitive ethnography will be presented and how it was applied in this study.

3.1 Cognitive ethnography
Hollan, et al. (2000) describes cognitive ethnography as a combination of different methodologies from other disciplines (e.g., interviews, participatory observation, audio and video recordings) as a way to study how cognition works in a distributed system of people and artifacts. They emphasize that traditional experiments still are an important part of the distributed cognition scientific framework. Hazlehurst et al. (2008) describes cognitive ethnography is a methodology involving the observation and description of activity systems in their natural settings (Hazlehurst, et al., 2008). Wilson et al. (2007) also argues for the use of ethnographic methods as a complement to traditional usability testing in a controlled environment.

The use of the cognitive ethnographic method is common in studies of cooperative processes in the health care context (Broome & Adams, 2005; Hazlehurst, et al., 2008; C. Nemeth, et al., 2006; Riley, et al., 2007; Tang & Carpendale, 2007; Wilson, et al., 2007; Wong, et al., 2009; Xiao, 2005; Xiao, et al., 2007). The relation between what people say they do, and what they in fact do does not always correspond. The combination of asking people what and why they do something in setting and observing what they in fact do, therefore increases the validity of the findings. The method requires the researcher to go out in the field and write down “what he observes”, by only relying on one person’s observations the risk of missing important events and details are higher. This risk can be reduced by the use of recording equipment (audio or video). This is however not that simple since the use of recording equipment also increases observer effects (Emerson, et al., 1995).

3.2 The procedure used in the study
The data collection for this study used methods from the cognitive ethnography toolkit. In total 40 hours has been spent at the four care units spread out over seven days. The reason that four units where studied was to increase the general applicability of the findings for the study. Although choosing units from different medical centre’s or even hospitals would have been preferable, this was not possible due to time constraints. During the entire fieldwork I was wearing hospital staff clothing this was due to sanitary concerns. This also helped me to blend into the work environment, this and the fact that the nurses in these units
were used to having nursing students following them around. This can be seen as
popitive for the reliability for the study and reduce observer effects.

The use of recording equipment in the health care setting raises questions and
corns of patient confidentiality, and no audio recordings where therefore
used. A digital camera was used during the last day of observation to document
artifacts central to the cooperation between the staff. The photos were made
anonymous concerning patient data. Even though I was wearing hospital clothing
and had spent six days there the staff reacted and confronted me about
permission when I took pictures, this illustrates how concerned the staff are with
patient secrecy.

The main data sources were participatory observations, opportunistic and semi-
structured interviews. The ethnographic data was collected by a combination of
“shadowing” of a single nurse and more stationary observations at the nurse
station. This was done to give a more complete picture of the system consisting of
individual nurses, the interplay between nurses and other professions at the
nurse station.

The scribbled field notes were typed out the same day after the observation
ended, these more complete field notes where then reorganized and categorized
info a more descriptive text. The method used for the categorization resembles
the use of affinity diagram (sorting related items into groups) as an example all
information from the field notes concerning “whiteboards” where put together.
The most central artifacts and practices are described and from them information
an communication needs where extracted.

3.3 Ethical information
An email containing information about the purpose of study was sent to the staff
at concerned care units. At the beginning of every observation this information
was repeated to the staff to ensure their understanding of the study. It was also
pointed out to the staff that they were to instruct the researcher when it was not
appropriate for him to be present in a situation. They were also informed that all
collected material would be anonymous and that all data would be handled
according to the signed terms of confidentially. In the semi-structured interviews
the participant was once more informed about the study and that their
participation was entirely voluntary and that they could abort the interview
whenever they wanted.

1 See appendix 2 for this information (in Swedish)
4 The field study
This section presents the ethnographical data from the field study, the data are presented in the categories described in section 3.2.

4.1 The care units in the study
The four care units studied in this case study are all parts of the heart centre in a Swedish regional hospital. The care units have a total maximum of 51 beds and over a period of 24 hours around 100 people works in connection to them. The care units studied were; one heart intensive care unit (ICU) and three closely related units “traditional nursing care units” (units X, Y and Z). The nursing staff in each care unit is divided into two “care-teams” (A and B), each care-team in turn has responsibility of half the patient rooms within the unit. The care units are located in the same building and are physically close to one another, this means that the staff often meets in elevators, break rooms and in the corridors.

Unit X, Y, Z are “traditional care units” and they treat patients who’s condition is not life-threatening but serious. They can be seen as a “waiting rooms” from where the patients go off to do different examinations or have surgery. The patients come to the units from; the ICU, from other clinics or by referral.

The ICU separates its self from the other units in a few ways; they receive patients who are in critical medical state directly from an ambulance or from the trauma centre. The patients at the ICU conditions are more acute and they require more supervision and treatment then the patients at the other units. Since the ICU only has 9 beds and they have to accept new patients, they always have a priority-list that ensures that they can move the least sick patients to the other units.

Most of the personnel (about 90%) “rotates” between the units. This as a side effect gives them a broader understanding of how and what the other units do, and how the units works as a large system connected to each other. As one nurse noted “everyone looks after their own first, but we help each other (units and care-teams) out since the situation could be reversed tomorrow”. This also has the effect that personal relationships between the staff exists and works over ”the formal boundary’s of the units”. This helps the different units to communicate and cooperate as a whole.

The share of acutely hospitalized patients in the units is according to the head of activity at the clinic around 70%, the rest comes with referral from other clinics or hospitals within the County.

The care units studied can according to IT-coordinator for the centre be seen as representative for other clinics in general at the University Hospital, she also
mentions that the care units often participates in pilot projects and are interested in the testing of new technology.

4.2 Responsibilities of the different occupations
The nursing staff have different responsibilities connected to their occupational role; the doctor has responsibility for the overall medical treatment of the patient (diagnosing and choices of medical treatment). The nurse has the responsibility of the patients nurturance and wellbeing during the hospitalization, and also for handling and administrating medicine. Assistant nurses have a supporting role in the patient care their role in the health care team hierarchy is below the nurses. Since there is no formal training to be an assistant nurse they operate under delegation from a registered nurse. Their job is to help the patients with “activities of daily living” and also to perform basic nursing procedures delegated by the nurses.

4.3 Description of a nurse in these units
Being a nurse is a versatile occupation that compass not only caring for patients, but also many different roles and responsibilities. The roles described below are overlapping and not exclusive in relation to each other.

Figure 1. Different roles of a nurse

The role a caregiver is the most common perception of a nurse, they care for, talks to and informs the patient. The communicator role consists of documenting and sharing patient data with the rest of the nursing staff, and also communicating with other care units. In the role of supervisor the nurse cooperates with and instructs other nurses and assistant nurses, and also organizes and plans the patient care. The subordinate role is relation to doctors, they outrank the nurses since they have responsibility for the patient’s medical
This role is expressed most explicit during medical rounds\textsuperscript{2}, and can also be seen more implicit when they perform other medical tasks ordered by the doctor. Examples of these delegated tasks are the handling and administration of medicine, and performing medical tests.

*A nurse was observed doing the “paperwork” related to the discharge of a patient at a computer at the nurse station, she described that the time required for completing this task was about 15min. This “activity” took at least one hour to complete. The reason for this was that every time she sat down to complete the task an alarm sounded, or someone from the staff would come by and ask her to do something or to help them with something. Every time she chose to do something else instead of finishing the paperwork she had to “lock the workstation” so no unauthorized person could access the patient record. One of the tasks she undertook during this period was giving a patient her medicine. When doing this she asked the patient if she knew what all the different medicine did, and since the patient didn’t the nurse took five minutes to go through the patients list of prescribed medications and explained the effects to the patient. When asked about this she answered “that by doing this she gave the patient a feeling of being involved in the treatment rather than just being subjected to it”.*

The above extract shows how a nurse has to prioritize what she does and when she can take the time to do something. She prioritized talking to the patient higher then completing the paperwork to empower the patient, this and helping her colleagues with “more urgent tasks” shows what I interpret as empathy. This pattern was frequently observed during the 40hours in the different units. The expression “putting out fires” is used by the staff to describe how they prioritize during a regular workday. This could suggest that that nurses working conditions are very stressful, that might be the case. But when asked about how they experienced the work in relation to stress most of the nurses replied something like “it’s no use getting stressed, you can only be at one place at a time”.

4.4 Description of the nurse station

*When I entered a nurse’s station (unit Z) for the first time it gave me the feeling of entering into a control room, it had six computers and a big whiteboard displaying a lot of information. Windows facing the corridors that enabled them to see of anyone entered or exited*  

\textsuperscript{2} Medical rounds are when doctor(s) and nurse(s) discuss the patient’s current state and treatment options.
their corridors. It also had three computer screens displaying graphs of patient’s heart activity and another display in the ceiling with red and green numbers flashing in sequence. In a room about 35 square meters five staff members (at the time) all dressed in white was working at computers and discussing a patient while looking at the whiteboard.

This first impression of this setting describes many central aspects of the nurse station. Its main function is to provide a workroom for the functions mentioned in section 4.3. It works as a “haven” for nurses and assistant nurses to return to after a performed task. The nurse station resembles a control room in the sense that it is “connected” to the patient rooms by different alarm and remote monitoring systems. When looking at the information flow in a care unit this room is one of the most important ones, since it is the “official place” where nurses and assistant nurses talks and discusses patient care and treatment. It’s also where they delegate assignments and share information (directly or via the whiteboard or notes). The reason for this is the obligation to preserve patient secrecy. The nurse station is also a place where administrative information is easy to find such as; phone and pager numbers, schedules, quick reference guides and so on. An important function at the nurse station is maintained during office hours by a secretary. Her duties include among other administrative tasks, answering the phones (and finding the concerned staff member) and the registration of new patients. The layout of the nurse stations between the units vary, in units X, Y and Z this room is like a shared office landscape with windows facing the corridors.
The ICUs nurse station “only has two walls” and a counter separates the station form the corridor. This makes the nurse station to a part of the corridor and forces the staff to be more careful to preserve patient confidentiality. In each nursing station there are presently both portable and regular phones, they are primarily manned by the secretary during office hours. The phones are used to talk to patients´ relatives calling to check up on their status, to communicate between care units, between centers and with the administrative office. The portable phones are primarily used by the secretaries, but are carried with the nurses during nightshifts since there are much less personnel during the night.

The nurse station also has more informal uses as “a room to take a breather in”, where social relations are formed and maintained and also a place for informal communication. These functions can be seen as trivial but they are an important part of the functionality of the health care system. The nurse station can be seen as an excellent example of a distributed cognitive system, consisting of many people and artifacts (whiteboard, post-it notes and patient records) working together over time towards a common goal (giving medical care to patients).

4.5 **Information sources today**

In this section the most central artifacts that work as information sources will be presented. One central information source not described in the text below is the patient or the patients’ relatives. It is from them that much of the information comes from and then gets written in the medical record.

4.5.1 **Medical records**

The main source of patient related information is the patient record it contains information about the patient’s medical history such as; previous hospitalizations, social status, family history of illnesses, medication and much more. It could be described as “the official truth about the patient” and is probably one of the best examples of a common information space.

> During the administration of medication the nurse asks the patient about one of his prescribed medication. The patient answers that he does not take the medication in question. The nurse looks confused and checks the record again, and refers to a consultation the patient had with another doctor a couple of months earlier. The patient tells the nurse that he remembers this. But he thought that the doctor who prescribed it didn’t make it clear to him why he should take the medication, so he didn’t even collect his prescription.
All the medical decisions concerning this patient up to his point were made by the nursing staff where made on the notion of that he had been taking this prescribed medication. This shows how much trust the nursing staff puts into the artifact. The patient record also has communicative side that allows the distributed system of caregivers to communicate knowledge about the patient indirectly. It gives the staff a view of the patient’s health over time and enables them to see "the big picture".

4.5.2 **Electronic medical records**

The medical record is one of the most central artifacts and has up to the introduction of electronic records been a tool that was mobile and the “use” of it was restricted to only one user at a time. The introduction of electronic records was made in these units in November 2008, and the access to the electronic records is today mediated through stationary computers and laptops.

The county uses a platform based computer system into which “software modules” with different functionality has been introduced over several of years. The modules are more or less integrated with each other. This has led to that an “ordinary nurse” needs to keep track of between 10-15 different usernames and passwords to be able to do her work. It also means a lot of interactions with different software interfaces. At present some information about the patient is registered outside of the electronic record, this is because the software (at present) does not support this information. There are two loose-leaf binders, one for each care-teams patients and one more specific for each patient. Paper based patient records have been used up to November 2008 and no data is "transferred" from them into the system. As a consequence a transitional period emerges where paper and electronic records coexist. Not having all the patient information available at same place poses a risk for the patient according to both doctors and nurses, as one doctor put it;

> "When 95% of the patient information can be accessed by Cosmic, it poses a threat to the patient if that last 5% isn’t available since it could contain critical information"

The risk of not having all the information available when making a medical decision puts the patients’ health at risk as well as creates excess work for the staff. Because of the transitional period from paper to electronic records and the gradual and the lack of integration between the software has put the nursing staff in a complex user situation. Where many rely on external memory aids (notebooks) to be able remember the login information just to be able to access

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3 The software in question: Cambio Cosmic, referred to by the staff as "Cosmic"
the systems. When they are logged in they have to remember how to perform their tasks in the different complex interfaces. This is currently supported by super-users\(^4\), quick reference guides and personal note. The present user situation is far from ideal. The way of working has not had the time to adjust to the new technology that makes it possible to view and write in a journal at multiple locations at the same time. This is according to the staff the biggest advantage with the introduction of the technology, and the reduced time spent searching or waiting for the physical record.

4.5.3 **Personal notes**

Nurses and assistant nurses both use personal notes as memory support for remembering patient information such as; scheduled examinations, reason for hospitalization, allergies and other relevant information related to the patient. These notes are a clear example of a personal information space and how can be used, and also of how users creates and modifies their tools for the task at hand. In the beginning of each shift the nurses and assistant nurses spend around 30 minutes writing down patient information in their own notes from the patient record. Choosing what information to write down, how to structure and color code this information is a matter of personal style. For this purpose some units has developed a printed style sheet\(^5\), the use the style sheet is optional. When asked why they use personal notes instead of the entire patient record the answer where:

\begin{quote}
They want information easily accessible and relevant to them in their work, and by choosing and adapting the information from the record they make it “their own”. It functions as both a support for memory and a checklist that lets them track the progress of tasks.
\end{quote}

These notes are informally updated between the members of the care-team and are not considered to be excess work since they continuously talk and coordinate their work anyway.

These notes work as a reminder for writing up a “shift report” into the patient record at the end of the shift.

\begin{quote}
After being away on a medical round the nurse comes back into the nurses' station and finds a post-it note on her care-teams laptop. The note is placed in the middle of the computer screen. It’s addressed to her and it has a message that she is to tell a certain
\end{quote}

\(^4\) Super-users have received more training then the general staff and provide in house support

\(^5\) See appendix 2
doctor to call a patient’s relative. She takes the note of the screen, and while she walks out into the hallway she tells the secretary that she’s going to search for the doctor.

Post-its are frequently used as reminders and for communication, and by putting the note in the middle of the screen it obstructs the use of the laptop and urges the nurse to deal with it before she can use the laptop. The positioning of the note is a clear example of how the spatial positioning effects how a note is perceived. If it had been put on the side of the laptop’s screen or somewhere else in the vicinity the level of perceived urgency would have been different. Post-its are used as reminders of how to use software, in this case the post-its are positioned on the side of the screen so they don’t obstruct the use.

4.6 Communication practices and artifacts
In this section the communication practices and artifacts that are used are described.

4.6.1 Informal communication
Informal communication is the communication not directly connected to the task at hand. This communication is both inter- and intra-professional. It occurs in; hallways, nurse station, break rooms, and it bridges almost all organizational boundaries. This information channel could be seen as gossip but it fills important functions such as teambuilding, information distribution and informal discussion forum. It’s also used to spread news about status of well known patients.

4.6.2 Between shifts
Units X, Y and Z use “silent shift changes” which means that the two shifts never meet each other and the only communication between them is mediated through the patient record. This means that at the end of each shift a nurse needs to write up a summary about each of her care-teams patients. As a memory support the nurse uses her own notes personal information space (PIS) and transforms them into a summary in the patient record common information space (CIS). At the start of the shift each care-team spends about 30 minutes reading through “their patients” records (CIS) and writing their own notes (PIS) about their patients’ medical history and other information that they deem relevant for their interactions with the patient.
A reading session was observed in a room in unit Z, in a room about 25 square meters, in it seven computer workstations were set up (17” screens, mouse and keyboard). The room was built to provide workstations for single users doing dictations and other work with patient records for doctors. The room was empty except for a care-team (consisting of a nurse, assistant nurse and a nursing student) who all sat in front of one workstation. The nurse “sat by the computer” and the others sat at her sides, she read out aloud from the patient record and the other two also looked at the screen. They also discussed the information in the records as they worked through them and they all wrote personal notes from the record.

Since the where three people all looking at the same screen they had to coordinate their reading, this method of using one computer could be a remainder from “the old way” (before the introduction of computerized patient records) of reading, when there only where one copy of the patient record. Some positive aspects of seeing the same information is that any ambiguousness can be solved by the group, and important information can be given extra attention. The design technology used to display the information on the other hand leaves a lot to be desired⁶. The room was according to the staff converted from storage room to the current state by the increased need for workstations connected to the introduction of the electronic patient records. The current design of the room does not support multiple users whether it is doctors or nurses having a reading session. This is because if someone is speaking in the room this will disturb all the other personnel in the room, since there are no separation between the workstations.

After the reading session is complete the nurse see all the patients to check on their current vital signs and how they are feeling. Once this is done a medical

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⁶ The clinic is currently "testing" using flat screen TVs, projectors and multiple screens for this purpose.
round is performed within each care-team, attending this is the doctor(s) in charge of the patients and nurse. The nurses main contributions is to provide updated patient information to the doctor(s), and take notes of relevant patient treatments and examinations. This can either be done by physically walking around and talking to the patients, or by just discussing them in a doctor’s office. The information of what has been said at the round is then spread by the attending nurse throughout the care-team in a more or less formal way.

4.6.3 **Within the same care unit**

Communication within the care-team is essential for the work in the clinic, since many people and professions are involved in the treatment of each patient. Out of the involved people the nurse is in the middle of it all since they have connections with both the doctor and are directly involved with the patient. The most commonly used and method for communication between the staff and between staff and patient is face-to-face interaction. Some of the most central artifacts supporting communication and information processes are:

### 4.6.3.1 Nursecall system

One of the most powerful artifacts when it comes to grasping the current situation and workload at the unit as a whole is the nursecall system with corridor lights which are positioned in both the corridors and in the nurse station.

![Nursecall system, corridor lights](image)

The display is divided into three fields. The red shows current alarms, the green shows in which rooms the staff are, and the red above shows the source. Most of the time several alarms and presence indications are active at the same time, the display then “flips” through these in sequence. When an alarm is activated in a patient’s room the alarm is “deactivated” by the staff when pushing the presence button on the wall inside the patient’s room. Each care-team are liable for “their patients” but since the alarm systems messages are not “exclusively sent” to this
care-team, the system permits “anyone” to respond to the alarm. Every time a
new alarm is set off a signal sounds through the corridor and the nurse station.
When this sound occurs the staff turns their attention to the corridor lights to see
what’s happening. According to the staff this gives them a general idea of the
situation in the unit. The nursecall system can also be used to “call” a specific
member of the staff to the nurse station. This is done by displaying a number\(^7\) in
green in combination with text in the upper field. This paging functionality is not
extensively used, the preferred method is walking around and looking for the
person, this is according to the staff this is because “if you peek your head into the
room they are in you see what they are doing and can then assess if they can abort
what they are doing or not.”.

4.6.3.2 Whiteboards
The work in the care units is oriented around the patients in the unit and a need
to share information about their status, planned medical test and so on exists on
both within and between shifts. The patient record is as mentioned above the
primary information source for the staff. But an additional need to quickly share
information that is available “at a glance” is also needed, this is facilitated by
whiteboards.

The nature of the whiteboard with the high level of openness makes them a
liability for patient secrecy, because of this they are placed inside the nurse
station. The information displayed in the whiteboard must also be adapted to
preserve patient secrecy, as an example only the patient’s first name and the first
letter of their last name is displayed. This information does not mean that much
to an outsider but to the staff with more knowledge about the patients it becomes
a powerful artifact.

The use of whiteboards within the medical context is widespread, and the
functionality of an artifact that provides the staff with an overview exists in all the
units. Although the functionality is the same the physical realization of these
extremely open artifacts differ between the units. The information on the board is
continually updated with relevant information about the patients’ status. As an
example of this the field that usually describes the patient’s medical problems can
be used to display information about how the patient is going to get home when
discharged. The board is used as what Krish (1995) refers to as a “jig” it triggers
the memory by providing some basic information about the patients for the staff
when talking to relatives over the phone. Since whiteboards are magnetic, the use
of magnets to put up information about the staff working at which care-team,

\(^7\) Everyone in the staff have their own number
priority lists and notifications are frequently used by the staff. The magnets are also used to put up printed labels for medical tests next to the patient name. The placement of the label reminds the staff that they should perform the test, and when they take down the labels to go perform the test this shows the rest of the care-team that the task is done. This use of the physical aspect of the labels and the placement of them is exactly what Krish (1995; 2004), Xiao (2005) and Bång & Timpka (2003) writes about.

Units X, Y and Z all use traditional whiteboards (1,5m *2m) as a base for displaying information. The upper fields are used to display administrative information about shifts, telephone numbers and on-call doctors. These are displayed by magnetic signs papers and writing with whiteboard markers. The differences between them are the main part that contains patient information that separates them, not in function but in execution. The ICU unit has because of its open design of the nurse station no whiteboard for this use, they presently use copies of the patient cards to provide the same function.

![Figure 5. The artifact that corresponds to the whiteboard in the ICU](image)

In units X and Y all patient information is written with whiteboard markers in different colors to code the information, this way of coding information is also described by Kisch (2004). The main part of the whiteboard is used to show information about the patients. This information has similar content as the personal notes described above. But since it’s a common information space the structure and content is more standardized. Each individual field on the whiteboard has a limited space therefore abbreviations are used and out of date information must be erased.
When the staff logs into the electronic medical records the first screen is a survey picture of the patients in the unit, the information on the screen resembled the information displayed on the whiteboards. This was taken advantage of in a pilot project in unit Z, and introduced a projector that was aimed towards the whiteboard. This combination of the traditional whiteboard and the new medical record software is a good example of what Garbis (2002) talks about users that create and modifies artifacts to fit their needs. The project was evaluated internally and opinions about the system are divided. Although the majority of the staff likes the new system, there is still much room for improvement. The fact that the program is not intended to be used in this way shows in the lack some of the features that makes whiteboards powerful artifacts. Such as color coding, the use of symbols and increases the work involved in updating information.

Figure 6. "Traditional whiteboard" at unit Y
The use of computer text instead of handwriting makes it possible to display more text within the same area (using space more efficiently), and also eliminates bad handwriting. One nurse commented “it shows too much information, you can’t see what’s important because there is too much information”. The same problems are mentioned with the traditional whiteboard, there is a tradeoff between showing a simple overview and showing all information. Another thing that speaks in favor for this configuration is that it eliminates the need manually update the whiteboard when a patient is moved or transferred, it also removes the risk of losing information by accidently touching the whiteboard. One important function that’s not supported by the software is the need to provide the other users with verification that a task has been performed. This in the traditional system is done by “checking off” the activity on the board, the staff quickly devised a way of showing this by putting an “X” in front of the performed activity.

My reflection about the combination of the two technologies are that this system with all the improvised solutions shows what are features and functions that are important for this kind of artifact. The fact that the projection area is also a whiteboard makes it possible to write temporary with a marker on the board and then update the electronic record when opportunity arises. The combination of technologies in the whiteboard in unit Z shows both how the users can create new artifacts and use existing artifacts in new ways.
4.6.3.3 Pagers

Pagers are today worn by all doctors in the center. There are both personal pagers and pagers connected to a certain roles. Personal pagers are less frequent within the nurse population, those who wear them have responsibilities that exceeds the normal nurses. The pagers that exists in the units are old and only shows the number that called, the wearer then have to locate a phone and call the number back. This also means that when you page someone you have to wait by that phone until they call back. The upside to using pagers instead of phones directly is that paged person can choose when to call back.

One role that has a dedicated pager is the “coordinator role” who is the person that keeps track of the patient situation for all the studied units, it is this person how has the task of providing an overview and solve problems related to lack of accommodation.

4.6.3.4 Alarm systems in general

The health care environment is full of alarm system that prompts for attention often by sounds. In the nurse station in the ICU the following alarm systems exists; the nursecall system, telemetry equipment 8 (three different alarm sounds) three phone lines, pagers and a ambulance alarm. These alarm system all compete for the attention of the staff and beyond these there are almost always people talking in the nurse station. This according to the staff forces them to more or less consciously to filter and sort alarms based on inductive reasoning, which leads to some hebetation. This is serious since the signal for "ECG-electrode disconnected" can mean anything from a cable is loose that the patient has fallen down on the floor in convulsions. The use of sounds to attract attention works fine when there are only a few systems but in the ICU the sheer numbers leads to an ineffective use of them.

4.6.4 Between care units

The communication needs between units is mostly concerned with transfers of patients, scheduling of examinations or the borrowing of equipment. These communication needs are very practical and are today mostly made over phone or in person.

In one of the care units nurse station a nurse discovers when she is taking out medicine for a patient that the units medicine storage is missing a specific medicine. She then proceeds to call unit X and ask if they got the medicine she’s looking for, she also uses this opportunity to discuss the level of occupancy in the other care unit.

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8 A system to remotely supervises and records patient heart activity.
Since both units have pneumatic dispatch system the other nurse sends over the requested medicine. The nurse made a digression to tell me with a wink “it’s important to call the units that have the pneumatic dispatch system when you’re searching for something, because if they don’t have it you have to walk all the way there and back”.

This example shows how the different units cooperate and “borrows medicine” this is another pragmatic solution developed by the staff to ensure the best care for the patient. There are many reasons for borrowing medicines between the units; they all have a basic supply of different medicines and needs beyond those must be purchased, medicine has expiration dates, inventory takes storage space and needs to be maintained.

4.6.5 Between clinics and different centre’s
Nurses in the clinical setting have very little (if anything) to do with communication between clinics and centre’s. The communication on this level is mostly concerning transfers of patients, and that’s done by the doctors.

4.6.6 Medical laboratory
The procedure for lab tests in the studied units are as follows: The doctor decides what test should be done, these are then ordered by a nurse or assistant nurse in special software⁹. And labels with a barcode and the patient’s name, date of birth, and what test (and the color of the test-tube) are printed.

![Figure 8. Color coded test tubes](image)

The test-tube with the “right color” are selected and the label is put on. The required sample is taken from the patient, then the barcode on the test tube is then scanned at the nurse station, this connects the order number in the software with the barcode on the test tube. The sample is then sent by tube to the lab for analysis by the pneumatic dispatch system. The results of the test are available

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⁹ Labros
via the software and can be viewed cumulative for each patient. The nursing staff must log in to the system to “check” if the test results are ready, since no notification function exists between the software and the staff. The task of logging in and checking if the results are ready is according to the staff frustrating and takes up time they could have spent working with their patients.

4.6.7  **Radiology department (coronary angiography)**

One frequent examination at the units is coronary angiography\(^{10}\), the time it takes to perform this examination varies from patient to patient, and therefore they use a numbered list instead of a fixed schedule. The working process starts with the doctor orders the test for a patient, an order is made by a nurse or assistant nurse in software\(^{11}\). The radiology doctor goes at the end of the day through the new cases and makes a priority list for the next day, this list is then distributed to the concerned care units. The next day the first patient are brought to the radiology department and examined. When the scan is complete the radiology department calls the unit and tells them to bring their patient back, and calls the unit where their next patient is. If an emergency case arrives the ongoing examinations are aborted.

4.7  **Summary**

In the above section some of the most central artifacts for information and communication in the units are described. The transition from paper based patient records to electronic has not been free of problem free and a lot of problems related to this still exist today. The different information and communication systems that exist today all have their strengths and weaknesses and should be seen as artifacts that support different needs and functionalities.

From the descriptions presented in this section the information and communication needs are extracted and presented in the next section.

\(^{10}\) An examination of the small blood vessels around the heart that transports oxygen and nutrition to the muscle.

\(^{11}\) Kundrad
5 Information and communication needs and design implications

In this section a generalized description of the identified information and communication needs of nurses will be presented, and from the described needs and current practices some design implications are made.

5.1 Information needs

Being a nurse as described above involves prioritizing what tasks to perform and when to do them always with “what’s best for the patient” in mind. It also involves cooperating over organizational boundaries with the purpose of helping out their coworkers. Therefore should alarm systems and information devices support this cooperative way of working.

Nurses’ working in this type of clinical setting use a variety of information sources to assist them in their work. The nurses in their regular workday need both a quick overview of the patients at the unit, as well as specific information connected to the individual patient. The patient record, the whiteboard and the personal notes comply with these needs today. The main differences between them how they are used.

The electronic records are a common information space and are the original source of information for both the whiteboards and the personal notes. The introduction of electronic patient records allows multiple users connected to and writing directly into the record, and no new way of working has yet been develop by the staff, the introduction of new technology to enable this functionality is needed.

The whiteboard is a common information space and therefore provides standardized information contents. It’s located in the nurse station and it is used by all the nursing staff. This means that the displayed information is not adapted to any specific occupational group. It provides an overview that is used both by the individual staff member and also as a coordination device used to discuss one specific patient or the unit as a whole. The combination of technologies in the whiteboard in unit Z shows both how the users can create new artifacts and use existing artifacts in new ways. What does the investigations made by other (Broome & Adams, 2005; Riley, et al., 2007; Wong, et al., 2009; Xiao, et al., 2007) and also in this study tell us about design implications for whiteboards? The mentioned studies conclude that the “traditional whiteboard” is well liked since: it’s a direct un-mediated manipulation of the information, it is a quick way to spread information because of its location and central role in the workflow. They
support indirect and direct communications and can be used to share central information, both administrative and patient information. The level of tailorability in a traditional whiteboard is only limited by the imagination of the users, the pilot test in unit Z shows how the users adapt and find sometimes solutions to problems created because of the lack of support of tailorability of the software. These findings gives important insights to designers of “whiteboards” as Wong, et al. (2009) shows, by taking these findings into consideration and involving the end-users the new design adds features rather than taking them away. It becomes apparent in this study that some positive aspects have disappeared when they introduced the electronic patient records or the “combined whiteboard” in unit Z.

The personal notes written from the journal gives the nurse the freedom to choose what information about the patient that is relevant to her specific patients and tasks. What information is chosen depends both on personal preferences and previous professional experiences. The current way a reading session is performed where several nurses and assistant nurses sit around the same information source (regardless of what viewing medium that used). This allows them to use their combined medical knowledge, to analyze the information available from the patient record as well as share their previous knowledge about specific patients. This makes the reading session a cooperative task that’s both distributed within the ongoing shift, and between them and all the previous contributors over time. The patient record builds over time and the “picture of the patients’ medical history” gets more and more details by each contribution. The design of the surroundings used for this purpose should be adapted to provide support for multiple users working together around the same viewing medium. As hinted in the description in the field study this might be a remainder form before the introduction of computerized patient records. But the way of working as a team and collaborating with other staff members in general suggest that the technology also should support this collaborative way of working.

This use of personal written notes could be seen as a relic of the paper based patient records, and that the electronic records will replace them soon. But one thing that opposes this interpretation is the way personal handwritten notes can be customized to fit the individual preferences and different professional needs. This might be different for doctors since their professional role requires them to take all information about the patient into account when diagnosing a patient.

Stationary computers and laptops are use to read and write into the patient records at present. The ICU has also tried using 9” tablet PC as a pilot project (in 2006). The project was a failure due to limitations in the immature technology
such as battery life and cluttered screens. The staff was positive to be able to interact with the patient record through a wireless and portable device. The review also concluded that the interaction with the laptop took too much attention from the interaction between the patient and the staff. This has implications for new technology aiming to provide the staff with the possibility of accessing the patient record (for both reading and writing) with a mobile device, the interaction with the artifact must be “transparent” so the use of it doesn’t affect the patient interaction. A speculation grounded in the responses from the staff, the internal review of the system and my own personal experiences with tablet based systems, is that you cannot use software developed for a traditional PC in tablet mode in an effective way. The software needs to be developed and adapted for the use, this is not the case for the patient record system that’s used in the units today. All the hardware (laptops, stationary computers and tablet-PCs) are standardized hardware developed for office or personal use. This is according to both Xiao (2005) and my own observation a contributing factor in to problems associated with technology in this setting.

The telemetry system is as described previous a pager connected to it, this pager is worn by the nurse who’s responsible for the system and the connected patients. This pager is connected to the alarm system and shows which patient the alarm concerns, the level of seriousness of the alarm. The mobile nature of the pager enables the nurse to assess the seriousness of the situation from where she is, this provides the accountable nurse with the freedom to work on other tasks while monitoring the patient’s status.

The nursecall system provides an interesting example of how a system provides many services; it shows which patient that requires help, where the personnel are, when phones are ringing and so on. By showing all this information it also provides the staff with an overview of the current state of the unit, and since the corridor lights are located in hallways, nurses stations, break and medical rooms they are almost always available to the nursing staff. The nursecall system is an central artifact that enables the staff to get an overview “at a glance” in a similar way as the whiteboard. The corridor lights shows a limited amount of information that means very little to “an outsider”, but the displayed information combined with the nursing staffs’ knowledge about the patients means considerably more.

5.2 Communication needs
The study indicates that the preferred method for the nursing staff within the unit is face-to-face interaction when possible and some form of indirect communication that can be displaced in time. Some examples of artifacts that
support this are: pagers, post-its, nurse call system, whiteboard. The use of a pager as an example means that when paged the user can choose (prioritize) responding immediately or finish the task at hand first.

The introduction of portable phones with a messaging function would without a doubt change the way of working for the nursing staff. How this new technology would be received by the staff can only be speculated on, but a central concern about portable phones is patient confidentiality. At present with face-to-face communication the staff needs to be aware of their surroundings when discussing a patient. And the possibility to move around while talking on a portable phone could heighten the risk of information leakage. At present the portable phones are used by the secretary with the purpose of allowing her to move around the unit and still being able to answer the phones.

5.3 Summary
The above section describes the need for different kind of information in different situations. The patient record, the whiteboard and personal notes provides different all have their strengths and weaknesses and cannot replace one another, and should be seen as different tools that complement each other and works best for different purposes and situations. The communication method preferred today within the care unit is face-to-face or indirect communication,
6 Design discussion

In designing artifacts for the health care setting a lot of design deliberations and tradeoffs have become evident, as well as some thoughts about design ideas. As noted in the preface the purpose of this study is to describe the health care environment and the needs of the staff. The main design discussion is left in the report to Ascom.

6.1 Design questions, deliberations and tradeoffs

One tradeoff is personal information vs. shared or common information, this tradeoff concerns standardization of both content and structure. The differences become clear when looking at the differences between the patient record and the notes made by the nurses. Another tradeoff is between details and overview becomes evident in the described example of the combination with a whiteboard and projector. The comment made by the nurse “it shows too much information, you can’t see what’s important because there is too much information” illustrates this tradeoff.

How big target group or how many professions could or should an artifact be adapted to, without losing the specific appeal to each group? This deliberation has connection to the different professional roles and responsibilities in the health care setting.

Another tradeoff connected to this is concerning the physical design of an artifact, the staff desires artifacts that are small, light easy to use, powerful, maintenance-free, that shows them the information (not more, not less) that they need when they need it. This claim combines a lot of tradeoffs since the more powerful and the bigger the screen gets most devices becomes the heavier, bigger, and have shorter battery life. The rapid development of new hardware technology helps to bridge this gap, but the tradeoffs remain even if they constantly become smaller.

Stationary versus portable is another interesting consideration, the trends in technology certainly goes towards making everything mobile and wireless. This means more freedom for the user, but also raises questions if some good things are lost in this process. When a device is made portable and wireless it means that it needs to run on batteries, and that the communication must work wirelessly. When entering a hospital today there are signs everywhere prohibiting mobile phones because of the risk of interference between phones and medical equipment, this can be seen as a sign of the backdrops of the wireless system. It also means that a mobile device physically can be brought to another geographical position, this means that they can be misplaced which forces the staff take time to search for them.
6.2 Some design ideas

After being in this interesting and complex environment I could not resist sharing some of my design ideas and reflections about the work.

The module based software system for one thing is something that attracted my attention with both the multiple interfaces and logins. I do not think that the use of enormous software program with support for every aspect of health care is the solution. But the current situation were ordinary nurses are forced to use that many different interfaces cannot be good for their wellbeing or the productivity. The different departments if it is a medical lab, radiology department or a nursing ward all have special needs that should be supported, this can be done by different software solutions. The important part is that they integrate in a way that gives the user a coherent and unified system feeling.

The current situation where a nurse is forced to handle 10-15 logins and passwords could be solved with thin clients that the users log in to by using a smartcard and password. The different occupational roles leads to different needs for information, this could be managed with providing the access to the patient records with different “filters” that hides information and functionality from the user thus decreasing the perceived complexity of the system.

Some kind of notification functionality should be provided to the staff when waiting for test results since the current way that forces the user to seek information takes too much time. This should however be done in well-considered way to not force the information on the user, since this could lead to information overload.

A useful addition to the functionality of the pager (as it works today) would be to provide the receiver of the message with “a level of urgency”.

Current technologies like PDAs and tablet PC´s are getting a lot of attention within the health care setting, and can be seen as a reaction to the computerized patient records. The design and implementation of these devices should however be on the basis of actual user needs, and not on any other basis. The technology should be seen as the way to get things done rather than for it to be a goal in itself.
6.3 General conclusions
The technological systems that exist in the care units in the study are developed and tested as separate parts and then combined with the existing system in the care units as parts of a big system. A real need is to integrate and streamline these different systems so that they provide the staff with an effective and coherent surface.

An important thing to notice is that the way of work does not change as quickly as the introduction of new systems and technology. The new technology however does affect how the work is done it takes time for the staff to adapt their working routines to the new conditions set by technology.

As one nurse noted "the new technology makes it possible to treat more medical problems, this leads to an increase in the number of patients that can and will get treated". This is in line with the argument of “stretched systems” (Hollnagel & Woods, 2005). The health care is an enterprise that needs to both get more efficient while remaining or getting safer. This puts them in a complex situation that requires a lot of attention and afterthought.

The health care system is a high paced environment filled with many different professionals with complementing skills and responsibilities. And technology should be specifically designed or at least adaptable to support these needs. The trait that describes the nursing staff the best is empathy both towards the patients and also towards each other. The sometimes stressful situations that arise in this setting are handled by the nursing staff as a team that supports each other.

The communication and information as it works today may not be perfect but by fixing and optimizing these flaws with new technology may have other consequences. One of these may be that the today balanced system of staff, artifacts and procedures get shifted. Even the small changes to this complex system could have unanticipated effects for the entire unit, clinic or even for the hospital as a whole. The negative effects of implementing new technology can be reduced by looking at the "bigger picture" and understanding how the work is currently done. It is hoped that the work presented in this study will contribute to such an understanding.
References


Emerson, R. M., Fretz, R. I., & Shaw, L. L. (1995). Writing ethnographic fieldnotes Chicago :


1 - Hierarchy of the organization
Information om studie av teknikanvändning på vårdavdelningar


Min uppsats skall utifrån ett användarperspektiv analysera vilka informations- och kommunikationskrav som finns för personal som jobbar på vårdavdelningar, men med fokus på sjuksköterskans roll. Uppsatsen är tänkt att fungera som en "förstudie" för att utforska vilka problem som finns idag och att belysa problematik som skulle kunna lösas av/med framtidens teknik, men också vilka möjligheter som finns att med ny teknik underlätta arbetet för personalen.

En utgångspunkt för mitt arbete är att se på en vårdavdelning som ett system som är uppbyggt av människor, maskiner, post-it lappar, whiteboardtavlor etc. Jag kommer därför att under några veckor följa med personal runt och studera hur arbetet fungerar med avseende på detta samt intervjua er som arbetar på avdelningen.

All information som samlas in kommer att anonymiseras och hanteras enligt gällande sekretessbestämmelser.

Har ni frågor om studien eller vill läsa rapporten när den blir klar så kontakta gärna mig på andma440@student.liu.se eller 0708923826. Ni kan också kontakta min handledare professor Nils Dahlbäck nilda@ida.liu.se eller 013-281664.

Med vänliga hälsningar
Anders Mannerhagen
Appendix 3- style sheet for personal notes

Avd 8, vårdlag A

Datum

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