

Integration or 'Patchwork' for Communication and Messages in a Hospital

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Problem Description

Most research concerning implementation and use of ICT in hospitals relate to information systems, such as EPRs, administrative systems, diagnostic tools, and lab systems.

In the article "A Patchwork Planet: Integration and Cooperation in Hospitals", Ellingsen and Monteiro (2003) describe a field study and formulate design principles for collaboration and integration of information systems in large hospitals. They argue that "patchworks" could be more beneficial than tight integration and centralized control of information systems in large organizations. There is little research, however, suggesting whether this strategy would apply similarly in "human-to-human communication and messaging", where a human callee, instead of an information system, receives a query. This type of communication makes demands on issues such as timing, interruption, and prioritizing calls and messages.

The candidate shall in this Master thesis perform a qualitative study at Rikshospitalet (The Norwegian National Hospital) and answer the following research questions:

1. How are messages between personnel at Norwegian hospitals handled?
2. Which technologies and methods for messaging are in use, and how are they used in different situations?
3. How satisfied are hospital staff members with today's practice, and what kind of improvements would they want? Are there different opinions between the professions?
4. How effective are today's messaging and communication routines?
5. How much integration between communication systems would be appropriate?
6. What kind of new functionality and systems would be desirable and practical?

Assignment given: 17. January 2007
Supervisor: Lill Kristiansen, ITEM

PREFACE

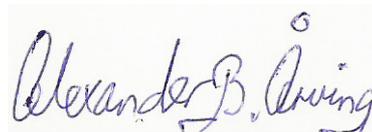
This Master's thesis constitutes the 10th and final semester of a Master of Science study and concludes my education in communication technology at the Norwegian University of Science and Technology (NTNU) in Trondheim. It is carried out as a fulltime study spring semester 2007, at Department of Telematics at NTNU and partly at *Rikshospitalet* in Oslo, as a directed study in the interdisciplinary field of specialization called "Technology, Organization, and Society" (TOS). This means that the thesis concerns technical as well as non-technical topics, and research methods from sociology are used to conduct the study.

I would like to thank Professor Lill Kristiansen, at Department of Telematics, for her support and guidance during the work on the thesis. She has shown a great interest in the assignment, and she has put forward helpful suggestions and information of great value.

My contact person at the IT department at Rikshospitalet, Ivar Olav Berge, deserves gratitude for the arrangement of my visiting at Rikshospitalet to conduct the field studies. He has shared a lot of knowledge with me and helped me getting in touch with other key personnel at the hospital. Finally, I would like to thank all staff members at the Children's Clinic who kindly let me observe and interview them in their work.

In addition to answering the research questions in this thesis, the field work at Rikshospitalet gave me an opportunity to try out research methods from sociology. Being a technology student not used to conducting social research, this could give my study a wider perspective. Also, I got the chance to get more familiar with health care and hospital work. I find it interesting to learn something about other domains than just technology and see how technology is used by people in various professions.

Trondheim, June 21st, 2007



Alexander B. Årving

ABSTRACT

Most research studies concerning implementation and use of ICT in hospitals relate to information systems. Various technologies and information systems are implemented in modern hospitals, such as EPRs, administrative systems, diagnostic tools, and lab systems. Common sense would suggest that collaboration—for maximum efficiency—would appreciate “seamless” integration of information systems and centralized control. Former research argues, however, that tighter integration in *human-to-system communication* could produce additional work or that it just relocates the workload instead of improving the efficiency and that “patchworks” sometimes are more beneficial than tight integration. The motivation for my research was to examine whether this strategy in hospitals would apply similarly in *human-to-human communication and messaging*, with a human receiver or “callee”.

This thesis presents some former research of ICT systems in health care and explains some relevant concepts from theory. It also provides a description of the health care domain, with information about the Norwegian health sector and hospitals. My field research was conducted at different sections at the Children’s Clinic at Rikshospitalet, the Norwegian national hospital. I used techniques from qualitative research (interviews and observations) to examine and evaluate communication routines and practices in the hospital. This thesis describes the most important types and technologies of communication and discusses thoughts and opinions among hospital workers on today’s practices and requests for future improvements.

Many hospital workers found some of today’s systems and practices for human-to-human communication interruptive, rigid, and cumbersome; and some improvements and changes could be desirable. An integration of voice and text messaging in handheld devices could improve the quality of clinical communication and reduce interruptions from using pagers. It could also be beneficial with context-aware communication systems, utilizing information about location and availability. Such information could be available through integrated functionality such as a positioning system, dynamic addressbook, and calendar applications. Due to different professions and roles in a hospital, though, it is hard to find common opinions. My research indicates that administrative and office personnel seemed more interested than clinical personnel in a tighter integrated communication and coordination system. Clinicians, however, tended to be a bit more skeptical of too much integration and new technology in human-to-human communication. Important aspects of human-to-human related work are flexibility, responsibility, professional judgment, and assessment of importance; and human contact and face-to-face communication will always be necessary.

When introducing new systems, it is necessary to take into consideration actual and different needs among hospital workers, information security and privacy, user-friendliness, robustness and backup, and user involvement. It is also worth bearing in mind that a hospital is an old and rigid type of organization with deep-rooted traditions, routines, and professions consisting of individualists. Improvements of communication practices and new functionality are desired and will most certainly occur as part of a modernization and digitalization process. However, hospital changes take time and must be done gradually with small steps.

TABLE OF CONTENTS

PREFACE	I
ABSTRACT	III
LIST OF FIGURES	VI
LIST OF TABLES	VII
ABBREVIATIONS AND DEFINITIONS	VIII
1. INTRODUCTION.....	1
1.1. MOTIVATION.....	1
1.2. PURPOSE OF RESEARCH	3
1.2.1. <i>Research Questions</i>	3
1.3. SCOPE AND LIMITATIONS	3
1.4. REPORT OUTLINE	4
2. BACKGROUND AND THEORY.....	5
2.1. TERMS AND CONCEPTS.....	5
2.1.1. <i>Computer Supported Cooperative Work</i>	5
2.1.2. <i>Articulation Work</i>	6
2.1.3. <i>Appropriation Work</i>	7
2.1.4. <i>Context-Awareness</i>	8
2.1.5. <i>Communication Overflow and Communication Deficiency</i>	8
2.1.6. <i>Health Specific Terms</i>	10
2.2. FORMER RESEARCH OF ICT IN THE HEALTH CARE DOMAIN	11
3. DOMAIN DESCRIPTION.....	15
3.1. THE HEALTH SECTOR IN NORWAY	15
3.1.1. <i>Regional Health Authorities</i>	16
3.1.2. <i>Te@nwork 2007 (Norwegian: S@mspill 2007)</i>	16
3.1.3. <i>The National Health Network</i>	17
3.1.4. <i>eHealth and National Competence Centers</i>	18
3.2. HOSPITALS	20
3.2.1. <i>Norwegian Hospitals in General</i>	20
3.2.2. <i>Rikshospitalet</i>	21
4. METHODS AND RESEARCH SITE.....	25
4.1. CHOICE OF RESEARCH METHODS AND TECHNIQUES	25
4.1.1. <i>Philosophical Perspectives of Qualitative Research</i>	25
4.1.2. <i>Qualitative Research Methods</i>	26
4.1.3. <i>Qualitative Research Techniques</i>	27

4.2.	CONDUCTED FIELD STUDIES	28
4.2.1.	<i>Research Site</i>	29
4.2.2.	<i>Deployment of Research Techniques and Data Collection</i>	30
4.3.	EVALUATION OF CONDUCTED RESEARCH AND VALIDITY OF RESULTS	33
5.	RESULTS AND FINDINGS	35
5.1.	AVAILABILITY OF ICT EQUIPMENT	35
5.2.	FACE-TO-FACE COMMUNICATION AND MEETINGS	36
5.2.1.	<i>Use of Face-to-Face Communication</i>	36
5.2.2.	<i>Opinions on Today's Situation and Future Improvements</i>	37
5.3.	E-MAIL	39
5.3.1.	<i>Use of E-mail</i>	39
5.3.2.	<i>Opinions on Today's Situation and Future Improvements</i>	40
5.4.	FIXED TELEPHONES	42
5.4.1.	<i>Use of Fixed Telephones</i>	42
5.4.2.	<i>Opinions on Today's Situation and Future Improvements</i>	43
5.5.	MOBILE TELEPHONES	44
5.5.1.	<i>Use of Mobile Telephones</i>	44
5.5.2.	<i>Opinions on Today's Situation and Future Improvements</i>	45
5.6.	PAGER CALLING SYSTEM	47
5.6.1.	<i>Use of Pager Calling System</i>	47
5.6.2.	<i>Opinions on Today's Situation and Future Improvements</i>	48
5.7.	NURSE CALLING SYSTEM	50
5.7.1.	<i>Use of Nurse Calling System</i>	50
5.7.2.	<i>Opinions on Today's Situation and Future Improvements</i>	51
5.8.	OTHER TYPES OF COMMUNICATION	52
5.8.1.	<i>Use of Other Communication Applications</i>	52
5.8.2.	<i>Opinions on Today's Situation and Future Improvements</i>	53
6.	DISCUSSION	55
6.1.	POSSIBLE CHANGES, IMPROVEMENTS, AND INTEGRATION	55
6.2.	DIFFERENT PROFESSIONS AND DIFFERENT OPINIONS	59
6.3.	USABILITY, USER-FRIENDLINESS, SECURITY, AND ROBUSTNESS	60
6.4.	SYSTEM DEVELOPMENT AND USER INVOLVEMENT	61
7.	CONCLUSION	63
8.	FURTHER WORK	64
	REFERENCE LIST	65
	INDEX	69
	APPENDIX A: POSSIBLE TECHNOLOGIES AND SOLUTIONS	72
	APPENDIX B: INTERVIEW GUIDE	78
	APPENDIX C: INTERVIEW AGREEMENT DOCUMENT	80

LIST OF FIGURES

FIGURE 1- 1: “HUMAN-TO-SYSTEM COMMUNICATION” VS. “HUMAN-TO-HUMAN COMMUNICATION”2

FIGURE 2- 1: TWO DIMENSIONS OF MODES OF COMMUNICATION (LJUNGBERG AND SØRENSEN, 1998)9

FIGURE 2- 2: AN ILLUSTRATING OVERVIEW OF TEMPORAL TRAJECTORIES, RHYTHMS, AND HORIZONS 11

FIGURE 3- 1: NORWEGIAN-BRITISH MODEL OF HEALTH SERVICE ORGANIZATION..... 15

FIGURE 3- 2: PATIENTS COMMUNICATE WITH HEALTH PERSONNEL THROUGH ICT (NST)..... 19

FIGURE 3- 3: THE MAIN ENTRANCE OF RIKSHOSPITALET AT ITS NEW LOCATION (PRIVATE PHOTO) 22

FIGURE 3- 4: SKETCH MAP OF THE HOSPITAL AREA (RIKSHOSPITALET – RADIUMHOSPITALET HF)..... 23

FIGURE 4- 1: UNDERLYING PHILOSOPHICAL ASSUMPTIONS OF QUALITATIVE RESEARCH (MYERS, 1997) 25

FIGURE 4- 2: THE ENTRANCE OF THE WOMEN AND CHILDREN’S CLINIC AT RIKSHOSPITALET (PRIVATE PHOTO) 29

FIGURE 4- 3: THE MP3 PLAYER USED AS AUDIO RECORDER 32

*FIGURE 5- 1: THE COUNTER SERVED AS THE WARD’S COMMUNICATION HUB AND SWITCHBOARD (RIKSHOSPITALET-
RADIUMHOSPITALET HF)* 42

FIGURE 5- 2: PROCEDURE OF CONTACTING PHYSICIAN ON-CALL..... 43

FIGURE 5- 3: THE ‘MOBILE PHONES PROHIBITED’ SIGN, COMMON IN MANY HOSPITALS (THORESEN, 2003)..... 44

FIGURE 5- 4: PHYSICIANS, SOME HEAD NURSES, AND SOME OTHERS CARRY PAGERS (IMAGE FROM IStockPHOTO) .47

FIGURE 5- 5: NURSE CALLING SYSTEM WITH ELECTRONIC BOARDS IN THE CEILING (HAUG ET AL., 2004) 51

FIGURE 5- 6: “MY DESKTOP” IS AN INTRANET PORTAL WITH INDIVIDUALLY ADJUSTED CONTENTS (ILL.: E-VITA) 52

LIST OF TABLES

<i>TABLE 1- 1: CLASSIFICATION OF COMMUNICATION TYPES RELATED TO TIME AND PLACE</i>	2
<i>TABLE 4- 1: STRENGTHS OF DIFFERENT QUALITATIVE RESEARCH TECHNIQUES (KUJALA AND LÄHTEENMÄKI, 2006)</i> .	28
<i>TABLE 4- 2: LIST OF INTERVIEWED HOSPITAL PERSONNEL</i>	31
<i>TABLE 4- 3: AGE DISTRIBUTION OF INTERVIEWED HOSPITAL PERSONNEL</i>	31

ABBREVIATIONS AND DEFINITIONS

BKL	Children's Clinic (Norwegian: Barneklubben)
BNS	Children Neurological Section (Norwegian: Barnenevrologisk seksjon)
CSCW	Computer Supported Cooperative Work
eHealth	Electronic processes and communication in Health care
EHR	Electronic Health Record systems
EPR	Electronic Patient Records
GP	General Practitioner
GPS	Global Positioning System
GSM	Global System for Mobile communication
GUI	Graphical User Interface
HDE	Health Domain Experts
HTML	Hyper Text Markup Language
ICT	Information and Communication Technology
IM	Instant Messaging
in situ	In its natural position or place
IS	Information Systems
IT	Information Technology
KITH	Norwegian Centre for Health Informatics
KoKom	National Centre on Emergency Health-Care Communication
LCD	Liquid Crystal Display
NSEP	The Norwegian HER Research Centre
NST	Norwegian Centre for Telemedicine
PACS	Picture Archiving and Communication Systems
patchwork	loose integration of various systems
PDA	Personal Digital Assistant
ProffNett	Professional mobile telephone subscription
RHA	Regional Health Authority
SMS	Short Message Service
Te@mwork 2007	National strategy plan for ICT in health care
TOS	Technology, Organization, and Society
XML	Extensible Markup Language

1. INTRODUCTION

This introductory chapter starts with a motivation for carrying out my Master's thesis. Then it describes the purpose of my intended research, listing a set of research questions to be answered. The scope and limitations of the thesis will be described, and the chapter also outlines the structure of the rest of this report.

1.1. Motivation

The biggest information repository in health care lies in the people working in it, and the biggest information system is the web of conversations that link the actions of these individuals (Coiera, 2000, p. 278).

The health care sector in general and a hospital in particular depend heavily on appropriate organizing and communication. Many research studies concerning implementation and use of ICT in hospitals relate to some sort of information systems. Various technologies and information systems are implemented in modern hospitals, such as EPRs, administrative systems, diagnostic tools, and lab systems.

Ellingsen and Monteiro (2003) have performed a field study of collaboration and integration of information systems in large hospitals. They have also formulated design principles for integrated information systems supporting collaborative work. Electronic patient record systems (EPR) are used to describe these issues through examples of EPR projects in some of the biggest hospitals in Norway. The purpose of EPRs is to establish collaborative work configurations across various departments and different kinds of users, through integrated information and processes.

Common sense would suggest that collaboration would appreciate “seamless” integration of information systems and centralized control, for maximum efficiency. Ellingsen and Monteiro argue, however, that this is not necessarily the case; tighter integration could, on the contrary, produce additional work or just relocate the workload instead of improving the efficiency.

While studies indicate that “patchworks” could be more beneficial than tight integration of information systems in large organizations, there is little research suggesting that this strategy would apply similarly in *human-to-human communication and messaging*. This is a motivation for looking into this kind of communication and coordination in hospitals.

There is a fundamental difference between cooperation among different individuals over time—through human-to-systems communication—and collaborative communication with a human “callee” or “receiver”. The latter type of communication in a hospital makes other demands on issues such as timing, interruption, and prioritizing calls and messages. Various kinds of communication technologies will also have different properties and thereby weaknesses and strengths in different situations, concerning aspects such as data storage characteristics, timing perspectives, and information security, to mention some. Mediated communication types can be categorized in a two-by-two matrix with place on one axis and time on the other. From this classification, as shown in *Table 1-1*, we get four different cases of communication with a combination of different or same place and different or same time.

Time ↑	Different time, same place	Different time, different place
	Same time, same place	Same time, different place
	place →	

Table 1- 1: Classification of Communication Types Related to Time and Place

Figure 1- 1 provides a conceptual representation of the main differences between human-to-systems communication and mediated human-to-human communication. The first type of communication happens typically at not the same time and thereby relates to the upper part of Table 1- 1, whereas the latter is usually in the lower-right category.

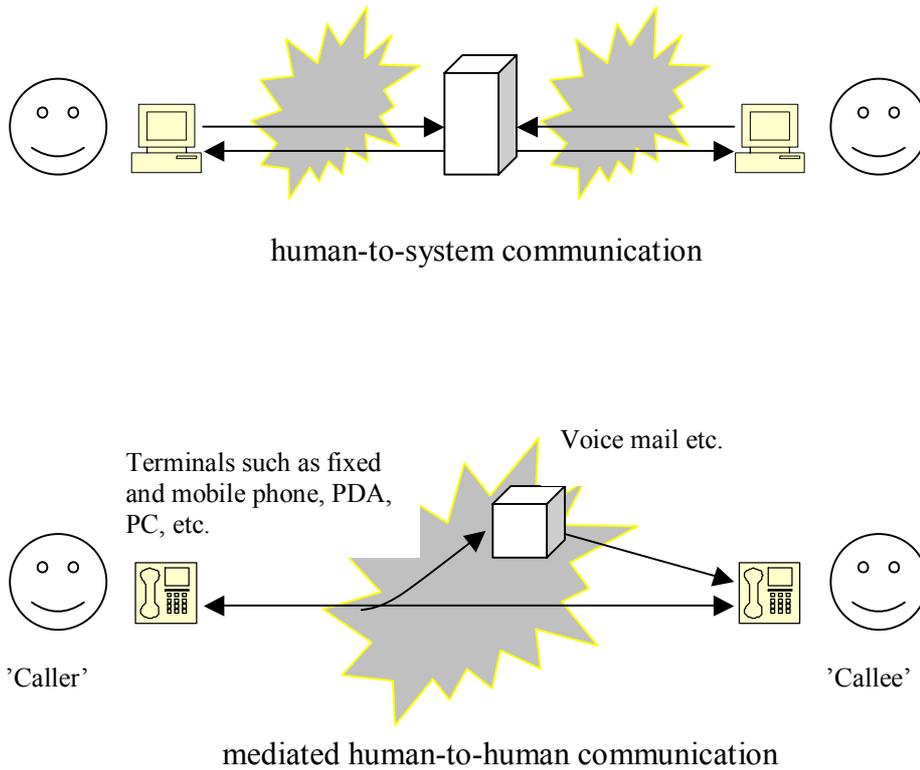


Figure 1- 1: "Human-to-System Communication" vs. "Human-to-Human Communication"

1.2. Purpose of Research

The intention for this Master's thesis was to visit the biggest hospital in Norway, *Rikshospitalet* (the Norwegian National Hospital), and study how communication systems and practices are used in daily human-to-human communication and collaboration.

The purpose of my research was to discover how physicians, nurses, and other personnel at the hospital communicate on a daily basis and to study how messages are handled in patient treatment. The findings from these studies were supposed to provide a basis for proposing a suitable level of integration of communication systems and perhaps making design rules for possible new systems.

1.2.1. Research Questions

This section lists some research questions that I aim to answer through my studies in connection with this Master's thesis. The questions are divided into two parts; the first relating to existing practices and systems in the present situation and the second concerning future possibilities.

Today's practice for hospital messaging:

- How are messages between personnel at Norwegian hospitals handled?
- Which technologies and methods for messaging are in use, and how are they used in different situations?

System integration and new systems:

- How satisfied are hospital staff members with today's practice, and what kind of improvements would they want? Are there different opinions between the professions?
- How effective¹ are today's messaging and communication routines?
- How much integration between communication systems would be appropriate?
- What kind of new functionality and systems would be desirable and practical?

1.3. Scope and Limitations

The main goal of the study in this thesis is to discover the present situation regarding communication and messaging routines and systems in a Norwegian hospital. I will also use these findings to discuss and mention some possible solutions for future systems. Based on my qualitative research, I will try to discuss which level of integration between communication systems would be suitable in a big hospital.

Due to the limited time available for carrying out this short Master's thesis and the fact that I have no former project work as a theoretical basis for this thesis, making prototypes,

¹ Effective means getting the most important things done—working smarter, not harder. Efficient means getting things done faster, quicker, longer, or better. You have to be effective before you can be efficient. (Maun, 2003)

designing specific systems, implementation, and testing are not comprised by my work. I will focus on explaining the foundation for possible further development of hospital communication technology.

Intentionally, I wanted to supplement the findings from my qualitative research with quantitative data from call logs, e-mail history, and possibly other message logs. Unfortunately, of reasons explained in more detail in subchapter 4.1 on chosen research methods and techniques, I have not got the opportunity to deal with this type of material. Hence, the empirical foundation for this thesis is merely the findings from my qualitative field research.

1.4. Report Outline

This report is structured in three levels of headlines. The first level consists of chapters, the second level is called subchapters, and the third level is referred to as sections. This subchapter lists the main content of the rest of the chapters in this report.

Chapter 2:

This chapter describes various terms and concepts from theory, which are relevant for my research. It also presents a selection of former ICT research from the health care domain.

Chapter 3:

The health domain is described in this chapter. This includes some general information about the health sector in Norway, with focus on ICT development, and hospitals as organizations and treatment institutions.

Chapter 4:

Chapter four explains the methods and techniques of qualitative research applied in the field study at Rikshospitalet. It also contains a brief description of the site where the research was conducted.

Chapter 5:

In this chapter I present the results and findings from the field research described in Chapter 4. The chapter contains a description of the most important types and technologies of communication in the hospital. It also presents thoughts and opinions among hospital workers on today's communication routines and possible future improvements.

Chapter 6:

In this chapter I discuss the findings from the field research and possible future solutions.

Chapter 7:

This chapter concludes the thesis and summarizes answers to the research questions.

Appendices:

Appendix A presents some possible, relevant technologies and solutions for future integrated hospital communication systems. Appendix B contains the interview guide used in the field work. Appendix C contains the agreement document used for the interviews.

2. BACKGROUND AND THEORY

This chapter aims to provide some background information about theory and previous research on information and communication systems in the health care sector and in hospitals. The first subchapter will present some theoretical concepts and terms from literature, which can prove relevant for my study. A selection of field studies of ICT that have been conducted in the health care domain will then be presented and described in the second subchapter.

2.1. Terms and Concepts

An abundance of different terms and expressions can be found in literature concerning social studies of information and communication technology and work practices in health care organizations. In the first five sections of this subchapter I will describe some general terms and concepts from literature of CSCW, which might be a valuable background for carrying out and analyzing my fieldwork. The last section of the subchapter, section 2.1.6, mentions some terms more specific for temporal work in the health care domain.

2.1.1. Computer Supported Cooperative Work

According to Schmidt and Bannon (1992), the term *Computer Supported Cooperative Work*¹, or CSCW for short, was introduced in 1984 by the researchers Greif and Cashman. The term was used to describe the topic of a workshop about how computers could support people in their work. Since then the term (and mostly the abbreviation) has been used by several researches, and it has become a field of research that includes studies of various types of communication supported by technology. Schmidt and Bannon (1992, p. 10) mention these applications as examples:

- Face-to-face meeting facilitation
- Desk-top presentation
- Project management
- Multi-user applications
- Text-filtering software
- Electronic mail
- Computer conferencing
- Hypertext

Pinelle and Gutwin (2006, pp. 545–546) also mention some other CSCW systems that can be suitable in health care settings, such as:

¹ Sometimes the second C in CSCW refers to 'Collaborative' instead of 'Cooperative'.

- Mailing lists
- Cooperative clinical document systems
- Indexing systems
- Picture archiving and communication systems (PACS)
- Telemedicine systems
- Electronic patient record systems (EPRs)

Sometimes the term *Groupware* has been used synonymously with CSCW. The case study of Pinelle and Gutwin (2006), which will be described further in the next subchapter, illustrates a groupware deployment framework for loosely coupled health care organizations. In their paper describing this field study, the researchers also write about CSCW deployments and CSCW systems when referring to their deployment framework for groupware. Schmidt and Bannon (1992, p. 10) argue that both terms are popular and that groupware mainly is used to describe “[...] design of software that supports group work,” while “[...] the term CSCW has come to be preferred in the research community due to its more comprehensive remit [...]” (Ibid.). They also argue that CSCW is a design oriented research area and that CSCW research should be constructive, rather than just descriptive, in order to be taken seriously (Ibid., pp. 11–12). Social science should contribute with studies of how cooperative work relations can be utilized in designing valuable CSCW systems. Although much of my study amounts to exploring existing communication practices, and hence must be said to be descriptive, I will also try to be constructive by proposing integration of existing and perhaps new systems, as mentioned in the subchapter of purpose of research (subchapter 1.2).

2.1.2. Articulation Work

The term *articulation work* is mentioned by Schmidt and Bannon (1992) as an integral part of cooperative work. Due to the distributed nature of cooperative work arrangements, there is a need for the distributed activities to be articulated or coordinated. Articulation work can therefore be seen as “[...] a set of activities required to manage the distributed nature of cooperative work” (Ibid., p. 18). Articulation of distributed activities is made possible when the collaborating participants have access to proper means of communication. CSCW systems allow people to cooperate and interact socially, and they thereby articulate distributed activities despite physical distance and time difference. In Ljungberg and Sørensen (1998) the term *coordination work* is used synonymously with articulation work, and it is defined as “[...] secondary activities required to coordinate, schedule, integrate, and mesh distributed and yet interdependent activities.” In the words of Balka and Wagner (2006, p. 237), these second-order activities are “[...] contributing to ‘making work work’.”

A lot of the activities carried out in health care or hospital work will probably fall outside of the established work routines; and hence, they could be referred to as articulation work. Winthereik and Vikkelsø (2005, p. 60) note that researchers use their knowledge about articulation work in studies of ICT in health care. Thus, when observing hospital workers in a field study setting, it is important to be aware of such additional coordination work. The fact that much of the work performed on a daily basis does not belong to formalized work routines can make it difficult for a person not familiar with hospital work to interpret all activities going on. This could also imply that some research methods could make it more difficult than others to analyze data. A discussion of choosing research methods and techniques and a description of how my research was conducted are found in chapter 4.

2.1.3. Appropriation Work

In their paper about system configurability, Balka and Wagner (2006) present the term *appropriation work*. They argue that system configuration must be seen in a larger context than just processes in a technical environment. Often configurability requires changes in the environment surrounding the technology itself. Other dimensions of configurability mentioned in the paper (Ibid., pp. 230–231) include:

- **Configurability of organizational relations:**
Organizational relations are an important part of the environment where new technologies are appropriated. Sometimes adaptation and configuration of technology in local branches of an organization may be in conflict with central organizational requirements.
- **Configurability of space and technology relations:**
Designing new systems should take into account the importance of spatial organization of activities. Sometimes it is necessary to be able to configure work environments differently for different activities.
- **Configurability of connectivity of people, places, and materials:**
People's possibility for arranging or re-arranging connections to other people and specific places also has to do with configurability. So does assembling and re-assembling of work materials, such as patient information.
- **Configuring as direct engagement:**
Whereas the three previous items relate to the environment in technology appropriation, the last two dimensions deal with aspects of *configurability support*. In connection with configuring as direct engagement, *transparency* and *accountability* are important elements. End users' direct engagement with artefacts and their direct feedback can serve as shared resources for coordination in cooperative work.
- **Configuring as part of technology use/work:**
In some work settings, configuring is encouraged and part of the daily work practices. In other environments, however, configuring may be more challenging, when leading to additional work or requiring intervention by specialized personnel. Disruption in work flow or break-downs may also occur; and in e.g. a hospital, this could have severe consequences.

According to Pipek (2005), appropriation can be thought of “[...] as a collaborative effort of end users to make sense of software artefacts in their work context” (as cited in Balka and Wagner, 2006, p. 230). Appropriation work can be said to involve how users integrate technology into their actions or work activities. Although much literature concerning appropriation work focuses on adoption and adaptation of technology, Balka and Wagner (2006) stress the importance of environmental changes and reconfiguring, “[...] by focusing on how people make the technologies work within a particular social and physical context” (Ibid., p. 230). In a hospital setting, environmental changes and reconfiguration could be hard to accomplish due to the characteristics of the work routines.

2.1.4. Context-Awareness

Another term appearing in relation to communication systems is *context-awareness*, and it can be conceptualized as a part of ubiquitous and pervasive computing. According to Dey (2001), the term *context-aware* was first introduced by Schilit and Theimer (1994); and in their work the word context was referred to as “[...] location, identities of nearby people and objects, and changes to those objects” (Dey, 2001, pp. 4–5). This definition uses examples to define context, and other definitions use synonyms for the word context in order to define it. Dey argues, however, that these types of definitions often get too specific or difficult to apply in practice; and for this reason he defines context this way:

Context is any information that can be used to characterise the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves (Ibid., p. 5).

Further Dey provides a general definition of context-aware computing. He claims that “[a] system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user’s tasks” (Ibid.). Jøssund (2006, p. 6) explains how wireless, technical equipment can utilize information from the surroundings in order to becoming “aware” of or interacting with the context in a communication setting. This information from the physical environment can be much more than location. As Schmidt, Beigl, and Gellersen (1999, p. 893) argue, location is just one aspect of context. They explain how advances in sensor technology can enhance context-awareness in ultra-mobile devices, and they mention possible sensor technologies in areas such as (Ibid., p. 895):

- Optical/vision
- Audio
- Motion
- Location
- Bio-sensors
- Specialized sensors (e.g. touch, temperature, air pressure, etc.)

2.1.5. Communication Overflow and Communication Deficiency

When having to deal with a lot of contextual information, the amount of information can sometimes grow too big to be manageable. At the same time we might experience the problem of too much interaction or wrong type of interaction between people. Ljungberg and Sørensen (1998) mention the dilemma of choosing between disconnecting oneself from all types of communication technology, in order to have time to get some work done, and staying connected with the possible result of being swamped with an abundance of calls and messages. For the first case they use the phrase “pulling the plug”, and for the latter they talk about “pushing up the daisies”.

Ljungberg and Sørensen (Ibid.) further discuss different concepts regarding possible problems of complex use of communication technology. In the following I will briefly sum up these concepts, which can be divided into the two main situations of *information overload* and *interaction overload*:

- **Information overload:**
The concept of information overload relates to situations where the recipient of information does not have enough cognitive capacity to deal with the total amount of information. It is worth noticing that information overload is not connected to communication patterns, instead it focuses on retrieving information from information systems such as large databases. The solution for overcoming the problem of information overload is to reduce the information quantity. This can e.g. be done by increasing the efficiency of information processing tools. Alternatively we have to increase our cognitive capacity for improved human information processing.

- **Interaction overload:**
The other type of overburdening is called *interaction overload*; and this has to do with interaction among people, where the amount of interaction exceeds a person's communicative and cooperative capacity. Interaction overload can further stem from either *communication overflow* or *communication deficiency*.
 - **Communication overflow:**
The problem of communication overflow is related to situations of undesired communication, where people are compelled to communicate although they are not interested in the content or the communicators. The context of the communication, in terms of time and place, may also be wrong in some situations. Regulation and filtering mechanisms can help distinguish desired communication from undesired communication.

 - **Communication deficiency:**
Desired communication through undesired modes of communication is the matter of the problem with *communication deficiency*. In some situations people participate in communication they are interested in, but they feel that the mode of communication is unsuitable. Distinctions between *unobtrusive* vs. *obtrusive* and *ephemeral* vs. *persistent* communications are made. This implies a two-by-two matrix and four different modes of communication which can be either obtrusive or unobtrusive at the same time as either ephemeral or persistent. This distinction and some examples are illustrated in *Figure 2- 1*.

<p>Obtrusive <i>Impose obligations to notice and react</i></p>	<p>shouting in a meeting or on the telephone</p>	<p>electronic mail with request to urgently reply</p>
<p>Unobtrusive <i>Inconspicuous interaction with no direct obligations to notice or react</i></p>	<p>humming, gazing, thinking aloud</p>	<p>discretely leaving trace, such as PostIt note</p>
	<p>Ephemeral <i>Only exist in the flux of unfolding activities and leaves no trace</i></p>	<p>Persistent <i>Leaves external trace</i></p>

Figure 2- 1: Two Dimensions of Modes of Communication (Ljungberg and Sørensen, 1998)

2.1.6. Health Specific Terms

When it comes to the temporal aspect of collaborative coordination in medical work, terms such as *trajectories* and *rhythms* appear in relevant literature. These terms are often used to describe concepts of different time perspectives in medical work, or any other work for that matter. Nilsson and Hertzum discuss several concepts in relation to their study of mobile work in home care, but they emphasize the “[...] two related but subtly different concepts” (2005, p. 149) called *trajectories* and *rhythms*. The first term relates to a longer time perspective than the latter, and trajectories are said to “[...] structure events by providing temporal sequencing” (Ibid.). The sequence of events is linked to a specific actor or work object; and in a hospital setting, this normally implies an individual patient and his or her progress through an illness (Reddy et al., 2006, p. 37).

When we investigate how several patients are treated over time in a hospital unit, we have moved from trajectories to *rhythms*. Reddy et al. (2006, pp. 40–42) explain how the concept of *temporal rhythms* characterizes many activities in hospital work. Re-occurring work patterns and people’s knowledge of these patterns are important aspects of work routines in a hospital, and periods in nursing shifts are mentioned as typical examples of temporal patterns consisting of repeated activities. Nilsson and Hertzum (2005, p. 149) also mention nursing shifts and morning rounds as examples of what they call large-scale rhythms in daily hospital work, while the time intervals in administration of medication are referred to as temporal rhythms of a finer-grained level. Lab results from patient tests, as mentioned in Reddy et al. (2006, p. 42), also belong to a set of finer-grained rhythms. Depending on the type of lab test ordered, the requesting staff members know when to expect the test results, which in this case normally are ready in either a half-hour or in a few hours. The staff thereby uses the information provided by rhythms to plan and coordinate work activities.

To briefly summarize the difference between the two concepts, we can say that:

[...] trajectories are largely patient-centered; different patients can have different trajectories. Rhythms are independent of a given patient and describe generic patterns of coordination and action (Reddy and Dourish, 2002, p. 352).

Reddy et al. (2006, pp. 42–43) also introduce the term *temporal horizons* when discussing temporal organization of work. The concept of temporal horizons can be understood as the way a person uses knowledge about rhythms and future tasks to organize work activities. Rhythms alone do not do any work themselves; the work is done by people responding to the rhythms in order to perform their tasks. Hence, “[...] temporal horizons are people-based, not activity-based” (Ibid.); and a person will normally have to deal with several temporal horizons at once. The person organizes work and makes plans for future tasks by altering and prioritizing activities. In the description of their hospital fieldwork, Reddy et al. (2006, p. 44) make a difference between *flexible* and *inflexible* temporal horizons. Sometimes a person experiences some flexibility regarding when tasks need to be completed. In cases where an individual must finish an activity within a certain “time slot”, the temporal horizon can be characterized as flexible. On the contrary, if the window of time for a particular task is limited to the time it actually takes to carry out the task, the temporal horizon is said to be inflexible. Although it can be useful to distinguish between flexible and inflexible horizons, the researchers do not make it clear how to define how much time can be said to be flexible.

Maybe this depends, however, on the specific activity and the individual's personal perception of the situation. A time slot of fifteen minutes can in some situations possibly be characterized as a flexible temporal horizon for a task in hand. In other situations, though, a tolerance of fifteen minutes can feel like a relatively restricted window of time.

Another classification made by Reddy et al. is *close* versus *distant* temporal horizons. In order to overcome a wealth of activities in daily work, it is important to "[...] have some idea of what activities are coming up and when they are going to occur [...]" (Ibid., p. 45). People's understanding of rhythms helps them to realize how fast they have to work in order to complete current activities. When experiencing a close temporal horizon, the work rate may have to be intensified in order to complete all tasks on time. A distant temporal horizon, however, offers a chance to work at a more relaxing pace and perhaps the possibility of postponing work activities.

A summarizing overview of the different temporal concepts, with a few examples, is shown in Figure 2- 2.

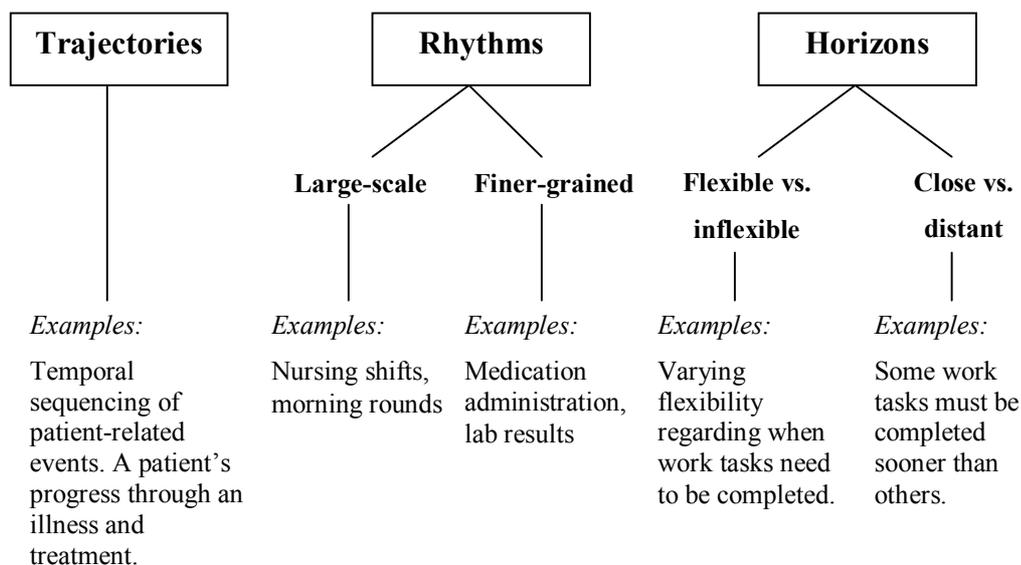


Figure 2- 2: An Illustrating Overview of Temporal Trajectories, Rhythms, and Horizons

2.2. Former Research of ICT in the Health Care Domain

The use of and implementation of information and communication systems in hospitals, and other parts of the health sector, have been the objective of several field studies over some years. These studies are mostly based on various methods within the field of qualitative research, meaning that the researchers have been present at the research site in order to observe and interpret working practices and the use of technology. My intended research seems to have some resemblance to many of these studies; and hence, qualitative research will be the basis for answering my research questions. Chapter 4 will present some theory of qualitative research and explain the research methods and techniques used in my field study.

Health care spans different organization types, and home care services are important in elderly people's everyday lives. Due to its distributed and collaborative character, home care work makes demands on communication, coordination, and technology to support it. Nilsson and Hertzum (2005) investigate, through an ethnographic study, the importance of temporal coordination and the use of technology among mobile home care workers. The researchers used qualitative techniques, such as participant observations, interviews, and workshop seminars, to conduct their study. During the observations the researchers followed home care professionals in Denmark for entire working days, on their routes from the main office to the homes of the elderly. Interviews were held in between the home visits in order to complement the observations made earlier, and analyses of the observations were presented later at workshop seminars.

Another case study of collaboration and organization in a home care setting is performed by Pinelle and Gutwin (2006). They investigated the deployment of a groupware system for home care workers in Canada; and patterns of work and collaboration in home care were examined with similar methods as in the study of Nilsson and Hertzum. The biggest difference of the two papers, though, is that the case study from Denmark focuses on exploring the collaborative work practices through theoretical concepts of time and mobility. Pinelle and Gutwin (2006), however, use their case study to examine a framework (which they have defined) of groupware deployment in loosely coupled health care organizations; and the focus is on deployment challenges and strategies of new technology in health care organizations.

Although the literature from studies of communication and collaboration in health care organizations includes home care and similar activities, most of the published literature describes field studies from hospital settings; and these are more relevant for my study at Rikshospitalet.

Many of the papers describing field studies in hospitals deal with implementation and use of different kinds of information systems. Winthereik and Vikkelsø (2005) study inter-organizational communication, and they focus on the roles of the discharge letter. Their empirical data stems from two different research projects carried out in Denmark, both concerning the use of EPR; one in a hospital and the other in general practitioners' clinics. Also in these studies the researchers made use of interviews and observations to discover the work practices of physicians and secretaries and their use of EPR.

Tellioglu and Wagner (2001) examined collaborative work practices and the use of a picture archiving and communication system (PACS) in a radiology department through a case study at a hospital in Vienna. The main concern of this study lies on spatial arrangements for collaborative work practices; and the study takes a sociopolitical perspective, which means that it involves a combination of social and political factors. Fieldwork was conducted over a three month period in the radiology department, but the paper does not describe further how this work was carried out and which techniques the researchers used. Wagner has also written an article (1993) about ethical issues regarding systems development and differences between professions in an organization. The article is based on an ethnographic study of time management and scheduling in a large hospital.

Integration of various information systems, in use at hospitals in North Norway, is studied by Ellingsen and Monteiro (2003; 2005). Their studies are based on an interpretive research approach including research techniques such as participative observations, interviews, document analysis, and informal discussions. The observations were mainly aimed at the work practices of physicians as an important user group; but also secretaries, nurses, and patients were included in the study. As mentioned in subchapter 1.1, Ellingsen and Monteiro concluded that a tight integration of information systems in large, complex organizations, such as hospitals, is not always appropriate. This conclusion serves as a motivation for my studying of *human-to-human communication and messaging* in a hospital and a discussion whether the argument also applies in this kind of communication.

Although the hospital studies presented so far deal with information systems, there is also literature concerning communication practices and collaboration between hospital staff members. Whereas Tellioglu and Wagner (2001) concentrated on the spatial approaches to collaboration, other studies (Reddy and Dourish, 2002; Reddy, Dourish and Pratt, 2006) deal with the temporal aspect of medical work. A common characteristic of most of these studies is fieldwork consisting of observations as well as formal and informal interviews in different hospital departments or units. Kane and Luz (2006) combined ethnographic observation with quantitative data in their study of multidisciplinary medical team meetings in a large teaching hospital. Combining qualitative and quantitative methods helps to understand processes and user perspectives. Additionally, it helps to review or validate earlier observations and measuring the impact of new technology and systems. Coiera and Tombs (1998) conducted a non-participatory, qualitative observation study of communication patterns among health care workers in a hospital. They also compiled statistics of call events, however, which supplemented their qualitative data.

A qualitative study from a hospital in Mexico is described by Muñoz, González, Rodríguez, and Favela (2003). Through observations and interviews of hospital workers with different roles and experience, covering physicians, nurses, social workers, assistants, chemist, and lab staff, the researchers gained valuable information before designing a new context-aware architecture and a messaging system. The qualitative methodologies gave them an understanding of how daily routine and non-routine work activities were performed at the hospital. A series of informal interviews were conducted, and the researchers were allowed to move around the hospital by themselves and talk to hospital staff members who were available for conversation. The studies of Muñoz et al. (Ibid.) describe how a context-aware messaging system can support information management and collaboration among hospital workers. The researchers identify a set of different contextual elements (Ibid., p. 335–336):

- **Location of people and devices:**
The type of information required by hospital staff members can be connected with the location they are in. Information should be sent to the location where it would be most useful in order to avoid overloading people with irrelevant information.
- **Timing of messages to be delivered:**
Communication exchanges in hospitals are often time-sensitive. A message may have a specific period of time in which it is relevant to be delivered.

- **Role-oriented nature of work:**
Due to work shifts and personnel turnover in a hospital, a message is rarely addressed to a specific person, but rather to a role such as a physician or a nurse.
- **Artifact-mediate nature of information gathering:**
Awareness of the state of artifacts, such as patient records, facilitates communication among hospital workers. Information exchanges can be triggered by the state of various devices and documents, such as temperature readings and availability of lab results, respectively. Relevant information can be delivered to hospital workers in a timely manner through monitoring of relevant artifacts.

These contextual elements are important aspects of collaborative work practices and information management in hospital settings. As noted by the Mexican researchers (*ibid.*, p. 332), hospital staff members are often distributed in space because their work is not characterized by sitting in an office all day. Due to the around-the-clock work and shift-oriented nature of work in hospitals, staff members are often also distributed in time.

The study of Scholl, Hasvold, Henriksen, and Ellingsen (2007) has some resemblance to mine, by examining human-to-human communication, such as pagers and wireless phones, in a Norwegian hospital. Their paper (*Ibid.*) has a socio-technical perspective of wireless communication in hospitals. The researchers conducted qualitative research in the form of participatory observations and interviews—of physicians only—at an oncology department at the University Hospital of North Norway. A motivation for their study was the little use of wireless phones and text messages in hospitals compared to other areas of society. Through their study, the researchers analyzed drawbacks and benefits of the use of wireless phones and pagers, respectively. Their findings indicate that physicians tend to be concerned about wireless phones being more interruptive than pagers and that some physicians prefer pagers over wireless phones. The researchers state that wireless phones in a hospital have some advantages, but that further research on how to use them effectively is necessary. Further, their data suggests that replacing office phones by wireless ones completely could be risky and create problems with over-availability for some physicians. Other professions than physicians, such as nurses or administrative personnel, are not emphasized in this study, and we do not get their opinions on hospital communication routines. However, in the paper's (*Ibid.*) section of future work, the researchers mention the possibility of expanding the study to include input from other hospital staff members.

3. DOMAIN DESCRIPTION

This chapter's aim is to present a brief overview of the health care domain in Norway. The first subchapter deals with the health sector in general, providing general information about its configuration and organization; and it mentions important aspects of ICT development. The next subchapter provides some information about Norwegian hospitals in general and more specifically about Rikshospitalet.

3.1. The Health Sector in Norway

Health services in Norway are relatively well developed. About 35 % of the annual state budget in Norway, or between seven and eight percent of the gross national budget, is actually spent on health and social care (Hygen, 2005, p. 1; Bergstrøm and Heimly, 2004, p. 337). According to Seim (2006), a lecturer in a medical course for non-medical students at NTNU, the organizing of health services in Norway can be described by what he refers to as a Norwegian-British model. In this model the patient goes to see his regular general practitioner (GP) when he is not feeling well. If it is necessary, the patient is then referred to a specialist for further treatment. Actually, about 90 % of all patient treatment is finished by the GP, 6 % is referred to a specialist, and 3 % is hospitalized (Ibid.). This type of organizing health services is illustrated in *Figure 3-1*.

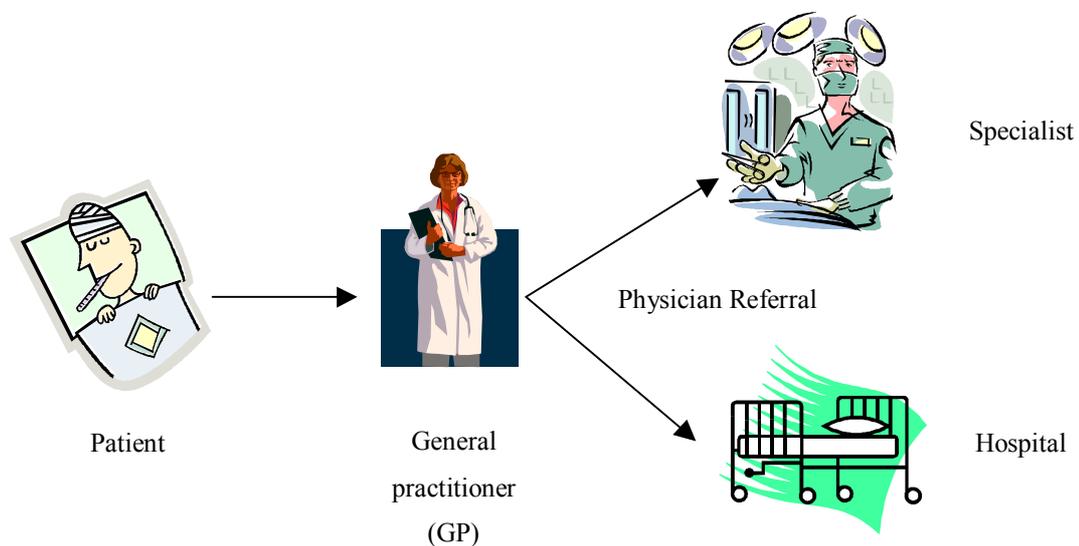


Figure 3-1: Norwegian-British Model of Health Service Organization

3.1.1. Regional Health Authorities

The configuration of the public health services in Norway can be divided into *local government health services* and *specialist health services* (Norge.no, 2007). Public general practitioners, emergency wards, physiotherapy, nursing homes, midwife services, and other nursing services belong to the first. All these services are provided by personnel employed by the local government or private practitioners through a contract with the local government. Additionally, the local government is responsible for carrying out preventive health work.

The specialist health services consist of all the public owned hospitals, psychiatric institutions, ambulance services, emergency call service, hospital pharmacies, laboratories, and some other institutions (Ibid.). In 2002 the Government undertook the responsibility and the ownership of the specialist health services and the hospitals. A Regional Health Authority¹, or RHA for short, was established for each of the five health regions in Norway. The five Regional Health Authorities are called:

- *Northern Norway Regional Health Authority*
- *Central Norway Regional Health Authority*
- *Western Norway Regional Health Authority*
- *Eastern Norway Regional Health Authority*
- *Southern Norway Regional Health Authority*

The website of Helseforetak i Norge (2007) informs about a decision which states that June 1st, 2007, the eastern and southern RHA will merge to a new RHA called *South-East Regional Health Authority*. At present date the biggest hospitals in Oslo, e.g. *Rikshospitalet* and *Ullevål University Hospital*, belong to different Regional Health Authorities, and cooperation and coordination between them can therefore be a challenge. In a newspaper article in February, Aale (2007) explains that over some years just a few of 21 cooperative projects between the two hospitals have been realized. Because the two hospitals belong to different RHAs, they have established their own services within highly specialized medical areas. The fusion of the two RHAs will, according to the chief executive officer at Rikshospitalet-Radiumhospitalet, provide new possibilities; and work groups have been established in order to find new coordination solutions within the year 2007 (Ibid.).

3.1.2. Te@mwork 2007 (Norwegian: S@mspill 2007)

In 2004 The Norwegian Ministry of Health and Care Services published a document about electronic collaboration in the Health and Social Sector, called *Te@mwork 2007*². This document describes a national strategy plan for ICT development in the health and social sector for the period 2004–2007. According to Helse- og sosialdepartementet (2004, p. 3), the purpose of this strategy is to offer the ICT development in the health sector a direction and a continuity. The plan lists two priority areas (Ibid.):

¹ In Norwegian: regionalt helseforetak or RHF for short

² The Norwegian title is S@mspill 2007

- **To improve the flow of information in the sector:**
This assumes work on elements such as infrastructure, information structure, information security, electronic patient records (EPR), message exchange, and access to professional support.
- **Include new actors more thoroughly in the electronic collaboration in the sector:**
Today electronic collaboration usually happens between health authorities, general practitioners, and social security offices. Other actors, such as patients and relatives, pharmacies, and other social and health services, must be included in the collaboration.

The importance of ICT development in the health and social sector is agreed on internationally. A statement from a meeting of Ministers of Health in the EU reads: "eHealth is the single-most important revolution in healthcare since the advent of modern medicines, vaccines, or even public health measures like sanitation and clean water" (Ibid., p. 4). Hygen (2005, p. 1) finds this statement promising, but he stresses the differences between medicine and sanitation on the one hand and information and communication technology on the other hand. ICT does not hold the same position in medical practice as the others. In today's situation paper based and ICT based solutions are often used side by side, and this means multiple jobholding and ambiguity in information management. In order to make the most of the advantages of using ICT in the health sector, paper must be replaced by electronic alternatives when possible, all actors must join the electronic collaboration, and the ICT development must be connected with organizational development and new types of collaboration and division of work (Helse- og sosialdepartementet, 2004, p. 4).

To improve the flow of information, the first priority area, the strategy plan points to six subordinate areas, listed below (Ibid., p. 12):

- A comprehensive and well-defined base of information
- A national health network
- Information security
- Electronic patient records (EPR)
- Consolidate the spread of electronic message exchange
- Professional support and sources of expertise

3.1.3. The National Health Network

The vision for the national health network is to contribute to effective cooperation between different service providers in the health sector (Ibid., p. 13). On its website (Norsk Helsenett), the Norwegian Health Network¹ is described as a closed network used by the health care sector for electronic communication and collaboration; and the foundation was established in September 2004. It is a public corporation owned by the five Regional Health Authorities with equal owner shares. The reason for the establishment of the corporation was, among other factors, the strategy plan *Te@work 2007*, described in the previous section. According to the goals listed on the website (Ibid.), a national health network can offer possibilities for improved technical services within the health and care sector.

¹ Original name in Norwegian: *Norsk Helsenett*

3.1.4. eHealth and National Competence Centers

Hygen (2005, p. 1) claims that the potential for information technology improvements and public, electronic services is not less in health care than in other sectors. Compared to other industry and private services, the health care sector can be considerably more information and cooperation intensive. As Hygen (Ibid.) also mentions, there is another aspect of health care which makes ICT development even more attractive. Advanced ICT services can compensate for the low population density and the often long traveling distances for medical services that characterize Norway.

ICT investment and broadband development in the entire country are important aspects of the Government's plan for an E-Norway, with ambitious goals for ICT development in private and public sectors (Bergstrøm and Heimly, 2004, p. 337). Some of the issues in the national health reform are regular GPs with one, appointed doctor for every citizen, free choice of hospital for patients, and central government administration of public hospitals and specialist health services (Ibid.). ICT is an important tool for implementing and supporting these issues of the health reform, and eHealth becomes a part of the general concept of E-Norway. In order to achieve the goals for eHealth in the strategy plan *Te@mwork 2007*, various national competence centers provide important contributions in the work on health informatics. In the following some of these competence centers are mentioned and briefly described.

- **KITH, Norwegian Centre for Health Informatics:**

KITH¹ is, according to its website (KITH), a limited company which was formed in 1990 and is owned jointly by the Ministry of Health and Care Services, Ministry of Labour and Inclusion, and the Association for Municipalities², with varying owner shares. The purpose of the company is “[...] to contribute to coordinated and cost-efficient application of information technology in the Health and Social Care sector” (Ibid.), and it has these five focus areas:

- Codes and terminology
- Electronic information exchange
- Information security
- Electronic Health Record systems (EHRs)
- Digital imaging systems/radiology

In 2005 KITH had about 30 employees, and the head office is in Trondheim. The company also takes part in international standardization work in Europe (Ibid.).

- **NST, Norwegian Centre for Telemedicine:**

According to Hygen (2005, p. 4), NST is part of the University Hospital in Tromsø; and its purpose is providing research, development, and consulting within telemedicine, in addition to introducing telemedicine services in real practice. In 2002 NST was chosen by the World Health Organization, WHO, as a collaborating center for telemedicine. NST claims on its website (NST) that telemedicine simply is ICT for health purposes, with exchange of patient information between treating or caring

¹ In Norwegian: Kompetansesenter for IT i helse- og sosialsektoren AS

² In Norwegian: KS – Kommunesektorens interesse- og arbeidsgiverorganisasjon

health personnel. Telemedicine also makes it possible for patients to communicate with health personnel through the use of communication technology and equipment such as computers, mobile phones, and TV. This is illustrated in *Figure 3- 2*.



Figure 3- 2: Patients Communicate with Health Personnel through ICT (NST)

- **KoKom:**

KoKom¹ is the National Centre on Emergency Health-Care Communication. It was, according to its website (KoKom), established in 1997 by the then called Ministry of Social Security and Health in Norway; and it is located in Bergen. The website (Ibid.) lists these main tasks:

- Be an initiator for health-related, administrative, and technical development of medical emergency call services and communication emergency preparedness.
- Provide for development and maintenance of national requirements for medical emergency call services, after consultation with public authorities.
- Be a catalyst in development of such emergency services, by own contribution and procuring expertise elsewhere.
- Contribute to correct use of medical emergency call services.

Hygen (2005, p. 4) informs us that the center acts as an advisor to central and local government, both counties and municipalities, on the running of dispatch centers in health care.

- **NSEP, The Norwegian EHR Research Centre:**

In 2003 the research center for electronic health records (EHR) was established at the Norwegian University of Science and Technology (NTNU) in Trondheim. On its website (NSEP), the center describes itself as a multidisciplinary research community at the university, which is involved in research projects regarding development, use, and usefulness of EHR. The center was established through funding from the Research Council of Norway and from the university itself (Hygen, 2005, p. 4). It receives financial support every year in order to “[...] develop and strengthen a multi disciplinary research community with competence from medical and health science, ICT and social sciences” (NSEP).

¹ Norwegian acronym for *Nasjonalt kompetansesenter for helsetjenestens kommunikasjonsberedskap*

3.2. Hospitals

Groth (1999, p. 42) claims that most writers seem to agree on two basic elements of organizations; and these are *division of labor* and the *need for coordination*, which requires both processing of information and communication. Division of labor between several people requires coordination of work tasks among the individuals because it is no longer possible for one person to have total control. This again implies communication in order to be able to coordinate work tasks (Ibid., pp. 45–46). Hospitals are without doubt one of the more complex organization types we have; and apart from some technological improvements, this type of organization has changed relatively little over the years. In addition to division of labor, a hospital is characterized by several important features starting with a C, such as Coordination, Collaboration and Cooperation, and Communication.

Hospitals are described by Groth (Ibid., pp. 385–386) as an organization type which can be called a *professional bureaucracy*. It consists of groups of different professionals who have received their knowledge through independent educational institutions. Here they have learned the knowledge they need in order to conduct their work, but they have also learned how to coordinate work activities with their coworkers and norms about ethical standards in their work. “Their decisions and the way they carry out their work are determined not so much by in-house rules as by their own judgment, built on the standards of their own profession” (Ibid., p. 385). These tendencies are easy to observe in hospitals, which are characterized by many different professions¹. Groth (Ibid., p. 386) also mentions the typical conflict between the professions, e.g. between physicians and nurses. He claims that nurses for a long time have tried to improve their standing and education and take over some of the work that has been the domain of medical doctors. Analogously there is a conflict between nurses and nursing assistants who dislike to be supervised by nurses. They also want to be closer to a nursing status and take over some of the nurses’ responsibilities. The relationship between doctors and nursing assistants, however, is according to Groth (Ibid.) often better because neither group feels itself threatened by the other; and the doctors’ professional authority is thus accepted by the nursing assistants. Such considerations of the relationship between hospital professions could be a good idea to bear in mind when analyzing data from qualitative research in a hospital. The following two sections provide some information about Norwegian hospitals and particularly about Rikshospitalet.

3.2.1. Norwegian Hospitals in General

According to Bergstrøm and Heimly (2004, p. 337), there are 85 hospitals in Norway. The Norwegian Ministry of Health and Care Services claims on its website (government.no) that the hospitals in Norway offer specialized treatment to the public, in addition to supporting research, education, and training of patients and relatives. The chief responsibility of the hospitals in Norway lies with the Ministry of Health and Care Services; all public hospitals are owned by the government, and they are organized under the five Regional Health Authorities described in the previous subchapter.

The Norwegian hospitals are supposed to contribute to (Ibid.):

¹ My contact person at Rikshospitalet informed me that the hospital had about 27 different health professions.

- Promoting public health; countering diseases, injuries, suffering, and handicaps
- Offering equal services, adapted to patient needs
- Ensuring proper service accessibility for patients
- Ensuring a proper use of resources

My contact person at the IT department at Rikshospitalet provided a brief description of how Norwegian hospitals function. Patients usually belong to a local hospital at which they receive treatment. In some cases it can be necessary to refer patients to other hospitals, e.g. Rikshospitalet, for special treatment. The local hospital then sends a written referral to the receiving hospital. Based on the patient's condition and requested treatment, he or she is received at the hospital in one of three different ways:

- **Polyclinic, or out-patients' clinic:**
This functions almost as a regular doctor's appointment. The medical investigation takes relatively short time, and a polyclinic note is sent back to the out-patient's local hospital or GP.
- **Day treatment:**
This is somewhat similar to the previous case; it takes, however, longer time and produces a little more documentation.
- **Hospitalization:**
A hospitalization usually involves these elements:
 - Entry
 - Tests and examinations
 - Treatment
 - Discharge with a discharge letter to GP

The following section will present a brief description of Rikshospitalet, as a small introduction to my field research at the hospital, presented in the next chapter.

3.2.2. Rikshospitalet

Rikshospitalet is the biggest and the national hospital of Norway, and it is situated in Oslo. In 2000 the hospital moved from the city center to its present location. The hospital merged with *The Norwegian Radium Hospital*¹ in 2005, the composition was called *Rikshospitalet – Radiumhospitalet HF*, or *RR HF* for short, and it belongs to the Southern Regional Health Authority, as described in section 3.1.1. According to Informasjonsavdelingen RR HF (2007, p. 6), the health enterprise RR HF has activities at several locations in the southern part of Norway. RR HF had 7865 employees in 2006 and an annual turnover of about NOK six billion.

According to its website (Rikshospitalet – Radiumhospitalet HF) the main objectives of the hospital include advanced treatment for patients, medical research, and teaching and advising at a high international level. In addition to providing advanced medical treatment and care, the

¹ English name for Radiumhospitalet

hospital is an important national research and teaching center. It is central in the work of developing and testing new forms of medical treatment, and it places its expertise at disposal for other hospitals and central authorities.

Being the national hospital of Norway and the most specialized hospital, Rikshospitalet treats patients from every part of the country; and many of them are resource demanding. It serves as regional hospital for the entire southern health region and also for some counties in the eastern health region. In addition to having the region hospital function, Rikshospitalet is also a specialized central children hospital for some close municipalities. Hence, the hospital treats everything from rare, complicated incidences to more common conditions; and it is a large pediatric hospital. Out of 585 beds in total, half of them being surgical beds, every fourth of them is a pediatric bed (Ibid.). The Children's Clinic was the location for my research, and it will be described further in section 4.2.1.

The hospital website advertises the hospital's location and appearance for patients and visitors in this way:

*Rikshospitalet is situated at Gaustad, north of Oslo town centre. The hospital buildings comprise 150,000 square metres, including 30,000 square metres for use by the university. Rikshospitalet moved to Gaustad in spring 2000. The new hospital is a low building that blends with the surrounding country. It resembles a town with open squares, streets, places of work, and private rooms. The hospital consists of several low buildings, interconnected by streets and bridges. Most of the patients, staff, and visitors arrive at the hospital via the square and main entrance. The traffic proceeds through a street under a glass roof, making it easy to find one's way about. On either side of this street there are outpatient clinics, a café, a canteen, pharmacy, library, etc.
(Rikshospitalet – Radiumhospitalet HF)*



Figure 3- 3: The Main Entrance of Rikshospitalet at Its New Location (private photo)

As mentioned above, I have also been in contact with the hospital's IT department. As opposed to most of the clinical departments, the IT department and some other departments are situated a short distance away from the main building (number 1 in *Figure 3- 4*). The location of the IT department (marked 7 in *Figure 3- 4*) is on the opposite side of a freeway, but in walking distance from the rest of the hospital.



Figure 3- 4: Sketch Map of the Hospital Area (Rikshospitalet – Radiumhospitalet HF)

The hospital website (Rikshospitalet – Radiumhospitalet HF) says that the IT department, as a service department, is supposed to be the hospital's preferred partner when it comes to questions and challenges regarding ICT. The aim of the IT department is to support the hospital's complex processes through creating solutions and developing and maintaining ICT systems that make it possible for the hospital to solve its primary tasks (Rikshospitalets IT-avdeling, 2004, p. 2).

Administration, maintenance, and development of the hospital's premises—including agglomeration of buildings, technical installations, and outdoor areas—are ensured by the property administration department (Rikshospitalet – Radiumhospitalet HF). This department's technical section has the responsibility for technical installations such as telephone networks. The telecommunication section has the responsibility for all the telecommunication at the hospital, with an around-the-clock rotation scheme. About 2000 calls are made on average each day (Ibid.).

The property administration department is located at the Norwegian Radium Hospital, which is in another part of the city than Rikshospitalet. This implies that there is a considerable distance between the technical staff and the users of the systems at Rikshospitalet.

4. METHODS AND RESEARCH SITE

In this chapter I describe how I conducted the fieldwork at Rikshospitalet in Oslo. In the first subchapter I discuss the choice of methods and techniques from qualitative research for my study. The second subchapter contains a further description of the research site and how the chosen research techniques were used to collect data. In the third subchapter I evaluate the conducted research and possible implications for the results.

4.1. Choice of Research Methods and Techniques

When we hear of research in social science, it often belongs to one of two main types of research. These two types are called qualitative and quantitative research, respectively. The purpose of my research was to discover and evaluate existing communication routines in—for me—a new domain. Due to the nature of the research questions, which seek to acquire an understanding of the present situation and human opinions, qualitative field research is more appropriate than quantitative research for collecting this type of data. Silverman (1998, p. 3) mentions just so the particular strength of qualitative research as its ability to study actual practice in its natural environment. Also, former research of ICT in health care similar to mine, as mentioned in subchapter 2.2, has applied methods from qualitative research; and this indicates that qualitative research probably is suitable for such studies. Hence, in the remainder of this subchapter, I will discuss how qualitative methods were chosen as a foundation for answering my research questions.

4.1.1. Philosophical Perspectives of Qualitative Research

Myers (1997) provides an overview of qualitative research and a classification of research methods based on the researcher's philosophical assumptions. According to Myers, qualitative research can be seen as positivist, interpretive, or critical. This distinction of the three different underlying philosophical assumptions in qualitative research can be seen in *Figure 4-1*.

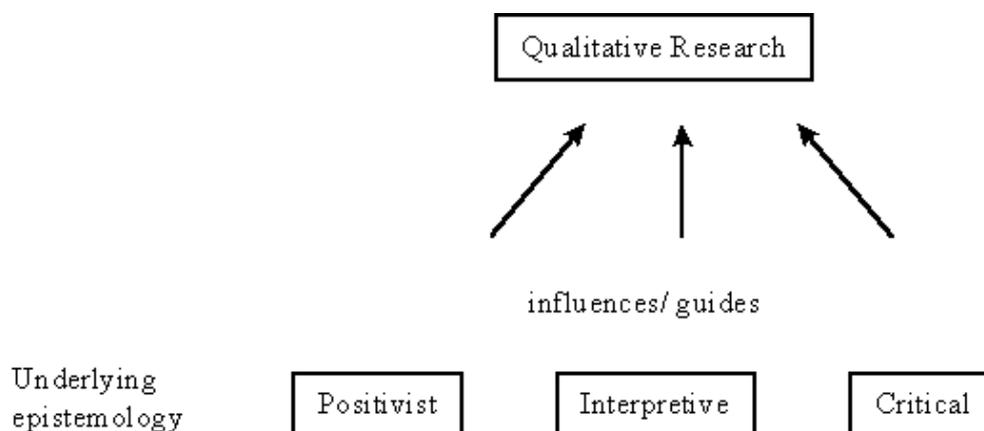


Figure 4-1: Underlying Philosophical Assumptions of Qualitative Research (Myers, 1997)

According to Myers (Ibid.), interpretive researchers have an assumption of getting access to reality through social constructions. These could be language, consciousness, or shared meanings. Phenomena are understood through people assigning them meanings, and the research methods are “aimed at producing and understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context” (Ibid.). My research questions deal with people’s relation to and opinions of communication systems, and I carried out my fieldwork with the assumptions that the reality is biased by the hospital workers’ attitude and meanings. Klein and Myers (1999, p. 69) claim that people often speak of qualitative and interpretive research synonymously. They stress, however, that qualitative does not mean the same as interpretive. “[Q]ualitative research can be done with a positivist, interpretive, or critical stance” (Myers, 1997).

4.1.2. Qualitative Research Methods

In addition to dividing qualitative research into different philosophical perspectives, Myers mentions various methods of qualitative research, which are independent of the underlying philosophical assumption. He defines a method as “[...] a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection” (Ibid.). Of the four different methods of qualitative research listed by Myers I will draw attention to these two:

- Case study research
- Ethnography

Case study research relates to describing a particular unit of analysis, such as an organization. This makes the case study suitable for research on information and communication systems in real life organizations, where “[...] interest has shifted to organizational rather than technical issues” (Benbasat, Goldstein & Mead, 1987. As cited in Myers, 1997). My study focuses on a particular unit of the hospital and work routines of the people working in it, and it is more concerned with understanding organizational and human issues regarding use and development of communication systems than technical issues of specific systems. Yin (2002) provides a definition of case studies (As cited in Myers, 1997):

A case study is an empirical inquiry that [...] investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.

Ethnography is characterized by spending a significant amount of time in the field and place the studied phenomena in the social and cultural context of the affected people (Myers, 1997). It could be discussed whether only one week in the field, as I had, can be considered “a significant amount of time”. As mentioned by Ljungberg and Sørensen (1999), however, ethnography typically—but not necessarily—implies an extended period of time in the field. Dourish (2006, p. 543) claims that the term *ethnography* often is used on “[...] investigations that are, to some extent, in situ, qualitative, or open ended.” Klein and Myers (1999, p. 69) mention that the principle difference between case studies and ethnographic studies is the length of time spent in the field and the profundity in studying the social group of the research. They also claim, however, that there is no hard and fast distinction between the two research methods. Thus, my study can be said to have some ethnographic features, but the

time frame for this thesis does not allow for a real ethnographic study. My research questions call for a qualitative research method in the direction of an interpretive case study of a specific hospital unit.

Before I started the work on the Master's thesis this semester, I was not acquainted with the field of social research from former courses or project work. Thus, parts of this semester have been spent getting an insight in social research. Silverman (2004) provides a discussion on the subject as far as theory, methods, and practice are concerned. This book deals with important parts of qualitative research, such as ethnographic studies; and it contains practical examples from other case studies.

4.1.3. Qualitative Research Techniques

Myers (1997) further explains that each of the research methods, mentioned in the previous section, contains different techniques for empirical data collection. Usual qualitative techniques constitute interviews, observations, and archival research. Field notes and experience from working in the field can also be valuable additions to the data gathered from other techniques. Walsham (2006, p. 323) argues that interviews should be supplemented by other types of field data in an interpretive study. He also stresses, like Klein and Myers (1999), that the word interpretive does not imply purely qualitative research. Although it is not necessary, interpretive studies could benefit from quantitative data of some sort in addition to qualitative findings. Kaplan and Duchon (1988, p. 575) mention the possibility of a combination of qualitative and quantitative methods in order to help interpreting and validating results. "Collecting different kinds of data by different methods from different sources provides a wider range of coverage ..." (Ibid.) than is possible with only one type of data. Silverman (1998, p. 7) supports this by saying that "[...] there are no principle grounds to be either qualitative or quantitative in approach. It all depends upon what you are trying to do."

As mentioned in subchapter 1.3, my initial intention was to supplement my qualitative findings with some quantitative data from telephone logs, e-mail history, and other types of message logs. It has, however, been difficult to get access to this kind of data due to strict polices regarding protection of personal privacy, and filling out forms and waiting for approval for treating material containing personal information take a lot of time. There are also practical challenges in connection with rules and regulations as to treating and storing material which can identify individuals. Due to limited time and other confined available resources in the work on my Master's thesis, I have decided to surrender the initial idea of comparing my qualitative data with quantitative log data. Hence, the descriptions and discussion in this report will be based exclusively on my qualitative findings from the field work.

Kujala and Lähteenmäki (2006, p. 4) describe field study as "[a] study to collect data in the users' own environment." They define the goal of such studies as identifying and understanding user needs and value for developing products. In order to find out which research techniques to apply, they present a table of which strengths the different techniques have (Ibid., p. 16). This overview of research techniques is presented in *Table 4-1*. Myers (1997) claims that a case study researcher primarily uses interviews and documentary materials without participant observation, and Walsham (2006, p. 232) agrees that most

interpretive studies contain interviews. Interpretive social science is also, according to Silverman (1998, p. 5) concerned with observation and description.

	Goals/high level tasks	Detailed tasks	Nonverbal skills, tasks	Context of use
Observing		X	X	X
Interviewing	X			
Artifact walkthrough		X		X
Think-aloud		X	X	

Table 4- 1: Strengths of Different Qualitative Research Techniques (Kujala and Lähteenmäki, 2006)

Given that I had very little time at my disposal for carrying out the fieldwork and that I am not used to social research, I decided on semi-structured interviews as my main source of data gathering, complemented by field notes from non-participant observations and informal talk with hospital staff members. Kujala and Lähteenmäki (2006, p. 10) mention a combination of semi-structured interviews and observing as an example of simple, but effective methods. As can be seen in *Table 4- 1*, a combination of these two techniques should also cover all the mentioned research areas and make it possible to answer my research questions. Observations should be valuable when finding answers to the first part of the research questions, relating to today's communication practices. Answers to the second part of the questions, evaluating systems and proposing improvements, should be obtainable through more in-depth interviews.

Due to the facts that I have never carried out social research before and that I have little previous knowledge of hospital organizations, it is not that easy when observing to understand and interpret all the activities going on in the daily work. In that way it is probably easier for an outsider to achieve more valuable information from interviews or conversations with hospital workers, with a possibility to ask questions to clear up confusion. Interviews could then support findings from observations. It should also be mentioned that one week, or five working days in the field, is probably too short time to get a real impression of the current situation at the research site in an unfamiliar domain and a broad enough foundation for an extensive data analysis.

The execution of the chosen research techniques at the Children's Clinic are described in the next subchapter, after a more detailed description of the research site.

4.2. Conducted Field Studies

In this subchapter I will describe where and how the field research was conducted at Rikshospitalet. The first section of the subchapter presents the research site, and the second section describes how the field studies were conducted and how I applied the chosen research techniques.

4.2.1. Research Site

The actual field research for this Master's thesis was conducted at the Children's clinic¹ at Rikshospitalet, situated at Gaustad, north of the city center of Oslo. The Women and Children's Clinic is a dedicated part of the hospital with its own entrance on the opposite side of the hospital's main entrance. It is, however, connected to the other main buildings.



Figure 4- 2: The Entrance of the Women and Children's Clinic at Rikshospitalet (private photo)

Prior to the fieldwork, I had a few meetings with my contact person at the IT department at Rikshospitalet, and he helped me getting in touch with key personnel at the Children's Clinic by serving as a "gateway" between the IT department and other departments at the hospital. He also claimed that this clinic should be a good place for conducting field studies due to its distinctive characteristics. According to my contact person, the Children's Clinic (or BKL for short) has about 400 employees; and it can be considered as a kind of miniature of the hospital itself. It contains several different wards and sections, similar to the rest of the hospital in a smaller scale, specialized for treating children with various illnesses and injuries. Examples of units that constitute the clinic are department of pediatrics, psychiatric section, heart section, and pediatric nutrition. Some of the most important operational units are a new-born ward, two normal bed wards, an out-patients' clinic, and the section for children neurology (Rikshospitalet – Radiumhospitalet HF).

The fact that BKL contains so many different units in a relatively small area made it easier for me to get a certain perspective of the disparity of hospital work. Given the short time I had at my disposal when visiting the hospital, I think I derived advantage from seeing more than one type of hospital unit; and it would be impossible to cover many different departments in the few days I had.

¹ In Norwegian: Barneklubben, abbreviated as BKL

Normal Bed Ward:

I spent the time of my field work mainly at two different sections at BKL. One of them was a normal bed ward, consisting of a long corridor with offices, a counter which functions as a reception or a service point, and patient rooms. This ward did not have any patient beds in the corridor, which generally seems to be a normal practice at hospitals due to lack of space and too many patients. The ward has room for 13 children at the time, and the children are aged between 0 and 15 years. Most of the children hospitalized here suffer from cancer or liver diseases, while some of them have neurological sufferings. The medical staff at the ward consists of three physician specialists in children's cancer, two physician specialists in liver diseases, in addition to a permanent ward physician and an assistant resident. The ward also has secretaries and a nursing staff divided into two groups (Rikshospitalet – Radiumhospitalet HF).

Children Neurological Section:

In addition to the above mentioned ward, I spent some time at the children neurological section¹. In the section's annual report for 2005, Sommer (2006, p. 2), the section leader, mentions the primary tasks of the section as medical diagnostics, medical reviews, and treatment, in addition to supervision of children in other departments. The patients are mostly children from 0 to 18 years old with congenital or acquired neurological diseases or injuries. All the work with these patients is organized in multidisciplinary functional teams. These teams cover areas like movement, communication, eating and nutrition, respiration, cognitive growth, neurogenic bladder- and intestinal disturbance, and following up new-born. The different professions involved in these multidisciplinary teams amount to this long list of specialists: physicians, nurses and social educators, urotherapists, physiotherapists, ergotherapists, psychologists, clinical therapists of nutrition physiology, special educators and social workers (Ibid., pp. 4-8).

4.2.2. Deployment of Research Techniques and Data Collection

The field research was carried out within one week in April 2007, during five normal work days. Usually I showed up between 7.30 and 8.00 AM, in order to witness the morning routines; and I stayed until sometime in the afternoon. This section describes how the chosen research techniques, discussed in the previous subchapter, were deployed in the field work. First I describe how the interviews with a selection of the hospital personnel were conducted, and then I explain how I observed and talked to hospital workers during their daily routines.

Semi-Structured Interviews:

The discussion of communication routines and technologies in this thesis is mostly based on the semi-structured interviews I conducted during the week of field studies. In total I managed to organize nine appointments with different kinds of people and professions. The people I had conversations with are listed in *Table 4- 2* with information about their gender and position at the hospital. The age distribution is presented in *Table 4- 3*. All the interviewees are employed at different sections at the Children's Clinic at Rikshospitalet.

¹ In Norwegian: Barnenevrologisk seksjon, or BNS for short.

Gender:	Position:
Female	Head nurse
Female	Assistant leader
Female	Patient coordinator
Female	Nurse
Female	Office manager
Male	Section chief physician
Male	Communication consultant
Male	Echo technician (nurse)
Male	Physician

Table 4- 2: List of Interviewed Hospital Personnel

Number:	0	2	3	2	2
Age:	20–29	30–39	40–49	50–59	60–69

Table 4- 3: Age Distribution of Interviewed Hospital Personnel

I wanted the conversations to be as open as possible in order to receive honest opinions and thoughts. This was accomplished by letting people speak relatively freely instead of having a prepared interview with nailed on, detailed questions. By letting the people know that I wanted them to tell me about what they knew, I hope that I created the impression that they were the experts of their domain and that I was interested in learning from them and hearing their opinions. In this way it might be better to call them health domain experts (HDE) instead of interviewees. Before the interviews, however, I gave them an interview guide, which I had written in advance, to prepare them somewhat on the topics that I wanted to talk about. In this way we may say that the interviews were semi-structured. They were based on some structured elements or topics, but no definite questions. This document also served as guidance both for me and for them during the interview, in keeping the subject of conversation on track. The HDEs often glanced at the list items while talking, and I used it for taking brief notes. The interview guide contained a brief introductory section, explaining the purpose of the document and the object of my Master's thesis. It also briefly explained how the interviews were thought to be carried out. Last but not least, it described the content of the conversations and the topics I wanted to discuss. The interview guide can be found in Appendix B (in Norwegian).

In order to make it easier to manage and analyze the data later, the dialogue in all planned interviews were recorded on an electronic audio recorder and transferred as audio files to my PC. An ordinary mp3 player with an inbuilt microphone, as shown in *Figure 4- 3*, was used. Without too much background noise, this kind of equipment works satisfactorily for recording voice from a conversation. The recordings were later transcribed and stored as text files. The audio files will be kept for about six months after handing in the report, for the possibility of re-examination. After this period of storage, the audio and text files will be deleted, and all the written notes will be destroyed.



Figure 4- 3: The Mp3 Player Used as Audio Recorder

Before each interview a written agreement was signed by me and the person I talked to. This document explained, in the same way as the interview guide, the purpose of my studies and the Master's thesis. It also stated that none of the interviews would include any sensitive information or patient information, and the intended use of the material was described. The interviewed person had the possibility to check off two conditions regarding further use of the material. After the interview I kept one copy of the signed agreement, and so did the other person. The template for this agreement document¹ can be seen in Appendix C (in Norwegian).

A time frame of maximum one hour was allocated for each interview. The HDEs were informed in advance that I would take not more than one hour of their time. Although 60 minutes were reserved for each interview, this was the total time per person. The effective time of talking and audio recording, however, was always less than 60 minutes; and some of the time was used for administrative purposes, such as reading and signing the interview agreement and explaining the context of the study.

Observations and Informal Talk:

Whenever I had spare time between interviews and planned activities, I tried to observe people at the different wards in their work and the setting in which it happened. In this way I discovered how people communicated in different ways in their daily routines. I also got an impression of how the spatial arrangements were and what kind of equipment that was present in different locations. These observations were done mostly by me as a "neutral" observer, where I did not involve myself in conversations and work tasks; and other people tried to ignore that I was there. Walsham (2006, p. 321) admits that he used to make a sharp distinction between what he called an *outside researcher* and an *involved researcher*. My observer role would then fall into the first category. However, Walsham finds it more suitable to see an observer's involvement more as a spectrum, with the "neutral" observer in one end and a full action researcher in the other. Although I behaved more like a neutral observer, it does not mean that I am unbiased. As Walsham confirms (Ibid), "We are all biased by our own background, knowledge and prejudices to see things in certain ways and not others." This is an important aspect to bear in mind when analyzing research data.

In addition to more or less occasional observations, some of them were planned. During the week at the hospital, I was invited to follow nurses around and attend some of their usual

¹ Called "Intervjuavtale" in Norwegian, in Appendix C

meetings and briefing sessions. I also got the opportunity to attend one of the multidisciplinary team meetings with the eating and nutrition team at the Children Neurological Section. When attending clinical meetings at a hospital, it is not possible to avoid overhearing patient-related information. Hence, it was important that the hospital staff knew that I had a clearance to be present when individual patients were discussed. Prior to the week of field studies, when preparing my research with my contact person at the IT department, I had signed a declaration of confidentiality¹. This states that I shall not reveal any information about patients, which I have been exposed to during my stay at the hospital; and it could result in criminal liability if I should break these rules. When visiting research sites where sensitive information are dealt with on a daily basis, such as hospitals, it is extremely important to gain trust from the staff in order to be accepted. Conducting field research at hospitals, which are characterized by hectic and interrupted work activities, may sometimes be difficult. It is for this reason necessary to find a balance between being humble and still show enough participation to get some work done during the research period.

The last day of the field work I also spent some time at the counter in one of the bed wards and got the chance to observe much of the activity in the ward. While the occasional observations were characterized by me being quietly attentive, the appointed observations were usually supplemented by informal talk and brief clearing up questions. For example at the counter, I sat at the desk next to the telephone switchboard with a cup of coffee and my notebook, observing the work of the secretaries. Every now and then, when they had a moment of spare time, they told me about their work routines and the systems in use. I also had the opportunity to ask questions to clear up things that I had observed on my own.

4.3. Evaluation of Conducted Research and Validity of Results

The results and discussion of this thesis should be interpreted in the light of the limitations of the methodology used for the research. Due to the fact that I had no quantitative data to complement my qualitative findings and that the number of interviewed people is relatively small, the research must be said to have a limited statistical significance.

My qualitative findings should, nevertheless, provide a basis for a further discussion of routines for human-to-human communication in hospitals and possibilities for introducing new systems. It is, however, important to be aware of possible limitations regarding the breadth and validity of the collected data. All interviewees belonged to the same clinic at one specific hospital in Norway. In order to obtain a wider spectrum of opinions on hospital communication, it would be necessary to compare results from other departments and perhaps other hospitals as well. Hospital workers have different needs depending on the professions, positions, and fields of specialty they hold. Still, my results show some general thoughts and important considerations when assessing the possibility of new communication systems.

When it comes to the selection of interviewees within the investigated clinic, all the participants were chosen by a contact person at the hospital unit. Hence, the selection process may have been influenced by this person's attitude towards the research project. Subsequent to the fieldwork, I see that some of the interviewed people may have been chosen due to their interest in technology, but I had little opportunity to make a random selection of hospital

¹ The title of the document in Norwegian is "Taushetserklæring"

workers as a visitor at a busy work site. The number of interviewees could preferably have been higher than nine, but the distribution between the genders was as close to fifty-fifty as possible with nine interviews. It would have been desirable with interviews of more mobile clinicians of both genders, compared to the number of administrative employees. The age distribution could maybe also have been less evenly spread. All interviewees were over 35 years of age, and seven out of nine were more than 45 years old.

As mentioned earlier, it is difficult to interpret the results of observations for an outsider with no previous knowledge of a domain. Thus, my observational findings have less value isolated than as supplements to the data from the interviews. In order to obtain the full picture of all hospital activities and work routines, more than one week of field work is necessary. It is also worth mentioning that the hospital workers may have been influenced by my presence. Although I tried to stand out as a neutral observer and interviewer, my background as a technology student and not a health expert may have affected the way the hospital workers answered questions and behaved during observations.

The results of the conducted research are presented in the following chapter.

5. RESULTS AND FINDINGS

This chapter presents the results of my fieldwork at the hospital. I have adopted a way of representation that deals with each technology or type of communication separately. There are some drawbacks connected to this way of structuring; some subjects relate to more than one of the technologies; and hence, the results could have been categorized under different theoretical topics instead of communication types. Another alternative way of structuring the chapter is a scenario oriented presentation with case vignettes presenting communication practices along a time axis representing a hospital work day. Nevertheless, listing and describing the various communication types separately should be a perspicuous arrangement of my findings.

The first subchapter briefly mentions which ICT equipment different hospital workers have access to and employ. Then the rest of the chapter presents the most important and most used types of communication and technologies in separate subchapters, which are divided into two sections where the first section provides a description of how the type of communication is used today. Based on the interviews and the observations, the next section of the subchapters presents some thoughts and opinions among hospital staff members when it comes to today's use and requests and suggestions for future improvement. To support the discussion, I will come out with various statements made by the nine different HDEs during the interviews, and I will try to detect potential variance and different opinions between different professions and roles. All interviews were held in Norwegian, and the quotations presented in this chapter are therefore my translation of the original statements.

5.1. Availability of ICT Equipment

Some of the ICT applications described in the rest of this chapter require access to computers. Although most administrative personnel and clinicians with their own office, such as section chief physicians and head nurses, have their own PC at their work place, many hospital employees are not that privileged. This involves groups such as regular nurses and house physicians. The communication consultant saw it as a practical problem that many did not have access to their own PC, but on the contrary had to share computers in watch rooms, lunch rooms, or other common places. He mentioned that it takes a lot of time for several people to log in and out of applications during a busy work day. Due to the deficiency of available computers, many hospital staff members do not have access to computer applications as necessary remedies in daily work. According to the communication consultant, these people tend to "pull the plug" and resign from communication and information sharing.

As far as landline telephones are concerned, the same applies. Employees with their own office have an office phone with a personal number at their disposal, whereas others have to use public available telephones in common areas. All physicians are equipped with pagers, but nurses do not carry any communication devices, except for possibly private mobile phones. The use of the various communication technologies will be described in more detail in the succeeding subchapters.

5.2. Face-to-Face Communication and Meetings

5.2.1. Use of Face-to-Face Communication

The first thing I noticed when I started my week in the field was the great amount of face-to-face communication at many occasions. Daily work at the different wards and sections consists of several planned meetings and briefing sessions throughout the day. The working day for the nursing staff usually starts with a morning meeting at 7.30 AM, which lasts about half an hour until eight o'clock. These meetings are held in a watch room or the nurses' break room, and a team of nurses are present. Face-to-face conversations are the most important way of communicating at these meetings. This is probably due to all the organizing and coordination that are taking place. Patients are shared between nursing staff and assigned to different wards for medical attention that day. This type of coordination and collaborative work duties are characterized by oral discussion and clearing up questions among the nurses. Additionally, a lot of written information is produced from the planning processes. Lists of patients are dealt with, and notes are written in note books and various schemes. I also observed that while the nurses discussed and made plans for the day, one nurse typed information into a calendar application on a PC. When the meeting was over, one nurse filled out information on a whiteboard on the wall about patients, patient rooms, and the people in charge.

The morning continues with other planned meetings before the patient rounds. Different special fields are covered through separate meetings, e.g. patients with liver diseases are discussed in one meeting, and the oncology team has another meeting. On these patient-related meetings, nurses, physicians, and sometimes other experts go through the patients they are responsible of, one by one, and have an oral discussion of the status of the specific patient and important changes, if any. The individual patient's clinical picture is hence discussed, and the treatment for that day is planned. During such a meeting, nurses share their experiences with each other and plan further treatment. Also here a lot of written material supplements the oral conversations. Diaries are used for planning the work shift, and the table is filled with patient lists, summary reports, and other forms. A large flat LCD screen, connected to a computer, was installed on the wall in one of the meeting rooms. This made it possible for the entire team to have a look at lab answers and patient information when discussing medicine doses and lab test values. Through a normal web browser (Internet Explorer was used in this case), the physicians and nurses had access to patient lists and electronic journals. An assistant physician used a web application to acknowledge test values, by clicking on a button below a column containing the values for a specific patient. By using the computer screen for these tasks, all the other team members could pay attention to what was going on during the oral discussions.

Although the meetings in the morning were part of daily rhythms and had a fixed starting hour, not everybody was attending the meeting from the start to the end. Various physicians and nurses entered the meeting room continuously in order to discuss the patients they were responsible of. Based on the knowledge of the fixed routines and the daily rhythms, a physician could drop-in on one of the meetings to e.g. inquire about the preparations for a specific operation later that day. He then knew where and when to get hold of the right personnel, for a short face-to-face conversation. In the transition from one nurse shift to

another (the nurses have three shifts during the 24 hours a day), handing over information about patients to the next shift takes place through a brief summary report.

When I attended the multidisciplinary team meeting with the eating and nutrition team at the children neurological section, I discovered the benefit the team members had of combining face-to-face discussion with written material and technology. In this meeting a team of specialists, consisting of several special educated pediatric nurses, a special educator, a social worker, and two clinical physiologists of nutrition, sat around a table in a meeting room. The basic type of communication was oral discussion of patients, one by one. In this way all the experts could evaluate the patients' progress from their own area of specialization and consult with the others. Printouts of graphs and diagrams from test results were shown in order to make it easier for team members to discuss the patients. A distinct characteristic of this type of team meetings is the use of video. The experts are usually scattered around the hospital area, and it is impossible for all of them to be present at every meal the children have. Because of this the children are filmed with a digital video recorder at some of their daily meals. In this way the team can watch the children's behavior and their reaction to the treatment on a TV screen in the meeting room when they are all assembled. When watching the video recordings together, it is easy to discuss the effect of the given treatment orally and plan for further treatment.

Not all face-to-face communication relates to planned or professional meetings throughout the work day. A lot of the oral conversations in the hospital were initiated on a more ad-hoc basis, either by looking up people of interest or by accidentally running into someone. Hence, face-to-face communication was used in a variety of situations, both for work-related conversations and for talk of a more private character.

5.2.2. Opinions on Today's Situation and Future Improvements

Due to the diversity in roles and professions among the hospital workers, today's communication routines and practices are comprehended differently. Based on the post a person holds, the need and the wish for a specific type of communication may be different than for a colleague in another position. Still, some communication types seem to be widely used and important for most hospital personnel.

Human Contact and Informal Talk:

The importance of face-to-face communication between colleagues, both dialogue and in plural, is expressed by most of the people I spoke to; and this type of communication seems to have two main purposes. First of all there are some patient-related subjects with a certain complexity, which require an oral dialogue or discussion about patient treatment during appointed meetings. In addition to these formal, professional discussions, human-to-human communication is important for other reasons in a workplace such as a hospital, where dealing with human tragedies and crisis are part of the work. The head nurse I talked to explained the need for such small, informal conversations, "Sometimes you just need to have a discussion about how you coped with a specific situation because there are many difficult situations, both with a professional perspective and with an inter-human perspective."

The patient coordinator also expressed the importance of seeing other people physically during a work day. When it comes to human contact, she said, "Yes, it is extremely important. If I just have to sit here with my computer, then I am not interested in my job anymore." In general she thought that face-to-face communication was a vital type of communication; and she ranked it as number one, before telephone conversations on second place and e-mail on third. She made it clear, though, that it depends on the situation which type of communication is better. When having to discuss something, face-to-face conversation is preferable, but e-mail is practical for short messages. Also the echo technician could mention that he preferred to look up people and go to them when he had a lot to talk about. He stated that after many years at the hospital, he knew most of the central people at the different wards. "So, if it is an operation I want to get done quickly or I have a question, [...] it is much easier to go and see people and find out what to do" (echo technician). He also claims that looking up people applies a certain pressure to them, which makes it easier to get things done. When calling people, however, in order to ask them when they have time for a specific task, the answer could often be a couple of hours.

Face-to-face communication requires, however, that people are reachable; and hence, this type of communication is affected by factors such as distance and availability. Several of the HDEs I talked to stated the fact that they used a lot of time actually searching for people. According to the assistant leader, informal and unplanned meetings were more common before BNS moved to the new location, and this is something they miss.

We used to be a pretty small section, and we ran into people all the time. And you only met those you worked with because we were the only ones there. And the office was only 30 meters away, so you could just go and knock on the door. Now you have to go perhaps ten minutes there and back, and you do not do that (Assistant leader).

Planned Meetings:

When it comes to planned meetings, some mentioned that certain improvements could be favorable. The head nurse expressed, "in the formal meeting situations, I believe that we would derive advantage from being perhaps a bit more rational, and it has something to do with the flow of the meeting and respecting other people's working hours." The assistant leader had the same opinion and said, "[...] there are always meetings that could have been shorter and better and could have been more organized."

However, not everybody wanted shorter meetings. The echo technician actually wanted a longer morning meeting. After the regular patient-related discussion in the morning, "[...] 15 minutes more then, where we can sit down and discuss all sorts of things and plan for the next weeks who will be absent when and such things, that is very useful." He admits, though, that this happens at the sacrifice of available time for treating patients. Nevertheless, he thought that it actually could be more effective because "it saves us from a lot of running, misunderstandings, and lack of information during the day."

5.3. E-mail

5.3.1. Use of E-mail

From the interviews I found out that e-mail was a frequently used type of communication and that it was used for a variety of purposes, both internally and externally. I got the impression that most of the hospital workers use e-mail on a daily basis. It depends, however, on a person's profession or type of job how the technology is used. For e.g. nurses and those physicians who do not have their own office with a computer, e-mail is used to get updated on what is going on at the clinic and to read the latest information from hospital administration. The most of their work day is spent treating patients or discussing the condition of patients with other nurses and physicians. At one of my meetings at the IT department before the actual field work, I learned that there were two important rules regarding the use of e-mail:

- E-mails containing medical content should not be sent to patients, and
- E-mails containing patient information should not be sent between medical personnel.

These regulations were later confirmed by the people I interviewed. However, the patient coordinator I talked to informed me that it was possible to send e-mails containing patient names etc. internally, on a secured e-mail system. E-mails sent to external recipients should be marked as non-sensitive information with this label:

In compliance with the Security Policy of Rikshospitalet-Radiumhospitalet, the content of this message (including any attachments) is of a non-sensitive nature.

The patient coordinator claimed that she was totally depended on using this secured, internal e-mail system in her daily administrative work, when planning and coordinating patient flow at BKL.

E-mail seemed to be the most important communication tool for those people who had a lot of administrative work duties. It was used for tasks such as:

- Preparing for meetings, sending notice of the meeting and presentations etc.
- Sending out minutes after a meeting
- Assembling people for multidisciplinary teams
- Coordinating resources for patient treatment
- Informing personnel about common administrative matters
- Contacting IT department about technical matters

Several of the persons I talked to mentioned that they received a lot of e-mails sent to mailing lists. The echo technician I had a conversation with said that people made use of mailing lists to send out common information similar to circular letters. He also mentioned another interesting aspect of using e-mail as a work tool. He said that he used the e-mail archive as his personal case files. "I actually try to use e-mail as much as possible. Because that is the only way I can document what I have done and try to remember what I said to whom and when", he said. In addition to using notebooks and memos, an e-mail application can be used as an archive of all job-related requests.

Functionality such as address book and shared folders in the e-mail client *Microsoft Outlook* are also a set of useful tools. Shared folders are used as a collaborative calendar tool to plan events on specific dates and time of the day, and the address book functionality is useful for finding contact information for a particular person. This type of functionality is mentioned further in section 5.8.1.

I also discovered that e-mail was often used as an alternative to voice mail, when trying to call a person. If the person did not answer the telephone in its office, a message was sent on e-mail instead of using the voice mail functionality to leave a message.

5.3.2. Opinions on Today's Situation and Future Improvements

Besides face-to-face communication and meetings, e-mail is a widely used communication technology; and most of the HDEs seemed to be satisfied with the e-mail system. They found it attractive to reply on a message when they had time to do it, and it was easy to contact people without knowing where they were at all times. The patient coordinator commented that "The advantage of e-mail is that I get rid of the message. I can hand it over." However, as the assistant leader calls attention to, the use of e-mail has positive as well as negative sides. She argues that e-mail works well for brief messages, but in cases where a message is sent to several people and everyone replies, it often gets too much to deal with.

Communication Overflow:

In section 2.1.5 the problem of *communication overflow* was mentioned; and as the assistant leader commented, the problem with e-mail is not brief messages between two colleagues, but rather mass information sent to several people. "If we are ten people and everybody gets the same e-mail and everybody replies, then you will eventually get dizzy of all the replies you get" (assistant leader). The office section uses e-mail frequently to send out common information, and the office manager admits that "As we send out that many messages, we see that people do not take it in. So that is the problem with that much information."

In the description of communication overflow in section 2.1.5, regulation and filtering were mentioned as a means of distinguishing desired communication from undesired. Several of the hospital workers talked about how they filtered the abundance of e-mails in a manual fashion and that it was easy to determine which e-mails that could be deleted.

I get a lot of e-mails into ... in my screen, as we say, and then I have to filter out what I have to deal with and what is interesting for everybody. Everything is not equally interesting for the office section, but in a way it is up to themselves to filter out what they want of information and not (office manager).

The communication consultant explains the problem of communication overflow in e-mails with the claim that "we have a communication strategy that is not functioning." One of the reasons why this is true is the fact that a lot of people do not understand the technology. They use the reply to all functionality when they should not.

Communication Deficiency:

Another type of interaction overload presented in section 2.1.5 is *communication deficiency*, and this is about inappropriate modes of communication. Although e-mail was used for a lot of purposes in the hospital—"it is used too much", according to the communication consultant—this type of communication was not always the most suitable.

Sometimes I find it easier to call people and explain things over the phone than sending e-mail. Those cases people call about and direct enquires are handled faster than e-mails (patient coordinator).

If the communication consultant were to speak his mind about e-mail usage, it was used in too many cases where it should not be used, such as for patient information. He had a feeling that the situation of sending patient-related e-mails internally at the hospital was out of control. Although some people feel that e-mail is not the proper type of communication channel for discussing patients, the communication consultant believes that physicians have something to do with it. "Physicians do in practice what they want, any time", he says.

And that is something they know very well. And that contributes to some of the challenges when it comes to introducing common rules, because physicians belong to a far from homogenous group; and they have little that connects them. They are a group of individualists compared to nurses or other groups, which in a way have a social structure and a management (communication consultant).

Another reason why e-mail was used for purposes where other types of communication would be better is explained by the communication consultant as an unsatisfactory intranet solution, "[...] because the choice of technology is too deficient, and it shall be replaced." The chosen technology does not fit with the way they work at the hospital; and hence, people are forced to use e-mail although it is not the desired mode of communication.

Sometimes, however, communication deficiency has the opposite effect and leads to e-mail as preferred over other types of communication. As mentioned in the previous section, e-mail was often preferred over voice mail when leaving messages after a failed phone call attempt.

It was also used to initiate telephone calls and plan face-to-face meetings, but sometimes it can be difficult to determine if and when a person has received a message.

The problem with e-mail is that you send a message and ask a person to call you, and then you don't get any response. But it is probably a solution to that too, a functionality that sends a message when you open a mail ... that is not much used. Yes, I am pretty sure that at least some companies have that solution (section chief physician).

5.4. Fixed Telephones

5.4.1. Use of Fixed Telephones

Regular, fixed telephone sets are found in many places at the hospital, but mainly in offices, patient rooms, meeting rooms, and in central places such as service points and watch rooms. A lot of the daily human-to-human communication in the hospital is old-fashioned telephone calls. When someone tries to get in touch with a person that has an own office, the office phone number is usually tried first. If the person is out of the office, other channels of communication are used, such as e-mail or the calling system described in subchapter 5.6. The fixed telephones are also used for returning calls on this pager calling system. Voice mail functionality is integrated in the telephones and can be used to leave a short voice message if the phone is not answered. The telephone sets are also equipped with numerical displays for showing information such as the time and caller ID.

Most of the telephone activity in the various sections and wards takes place in a central communication hub, such as a watch room for nurses or a counter that functions like a reception. When I spent some time with the secretaries at the counter in one of the wards, I observed how they handled incoming and outgoing calls on the ward's switchboard function. Calls made or received on the fixed telephones here were both internal between hospital personnel and external with e.g. patient relatives or taxi companies. The secretaries received calls and forwarded them to other offices and other telephones. In some cases they took a message and delivered it later in person or tried to find people physically in order to inform them of a phone call. A note attached to the switchboard telephone set said, "Do not use this telephone for paging." One of the secretaries later explained that the reason for this was that when someone is paged, they call back to the phone it is called from. As far as the switchboard telephone is concerned, another phone call is likely to occur in the meantime. Hence, other fixed telephones should be used for pager calling.



*Figure 5- 1: The Counter Served as the Ward's Communication Hub and Switchboard
(Rikshospitalet-Radiumhospitalet HF)*

On the wall at the counter, I observed a written note of how the secretaries should use a specific procedure in order to contact the physician on-call at the Children's Clinic. The content of this note is translated and reproduced in *Figure 5- 2*.

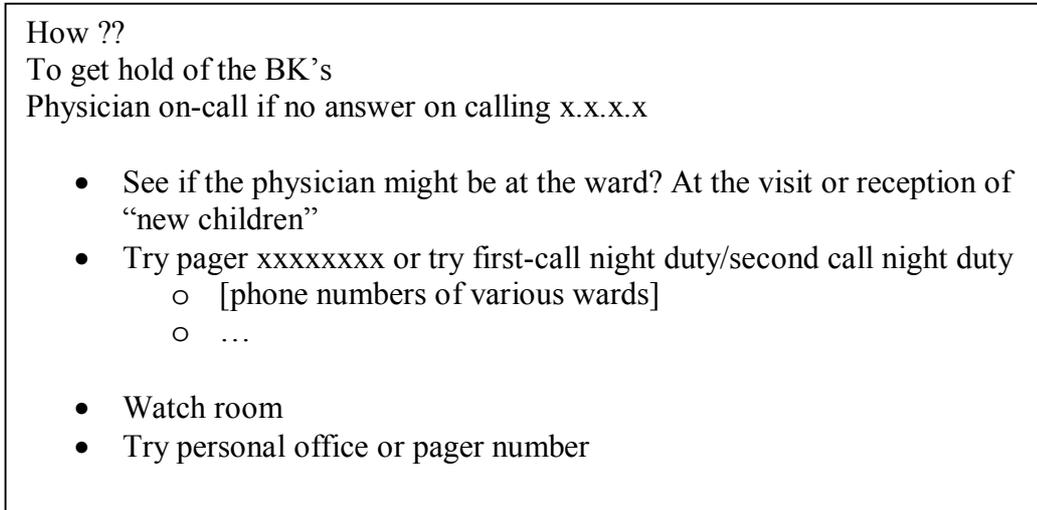


Figure 5- 2: Procedure of Contacting Physician On-Call

5.4.2. Opinions on Today's Situation and Future Improvements

Very often people are inaccessible through telephone during the day. This applies especially to nurses who are carrying out work on patients. They are difficult to get hold of because they are engaged in something with the patient that they cannot leave, or they accompany patients to tests and examinations (head nurse).

The head nurse emphasizes the fact that there are few phone calls the nurses have to answer right away, but they are lucky to have secretaries who can receive calls, take a message, and pass them on. It is good to have someone to consider the importance of a message.

At a department like this, which has a large patient turnover and a lot of activity, you are completely dependent on a competent secretary function that is able to actually make that judgment. We are lucky to have that because you need someone who knows what important information that is urgent and what can wait (head nurse).

Although someone chose to use e-mail instead of voice mail when leaving a message, the assistant leader mentioned that answering machine functionality could be a good thing. When calling a public institution, people expect to get an answer; and if a person is unable to answer the phone at the moment, leaving a voice message could be a proper alternative.

And then people are able to choose. If they want to leave a message, they do that; and if not, they can choose not to. So I often think that a telephone with an answering machine is just as good as e-mail, really (assistant leader).

The patient coordinator held a different opinion. She thought it was possible to use voice mail, but she had never used it.

But then I think you are just sitting there listening to the voice mail, writing down notes beside the telephone, and you have to call back later. It is much better that people rather call me back and talk to me. So I am in favor of simplification. That is, too many such technical ... it is quite a lot of extra work (patient coordinator).

The approach to this problem can be seen in elucidation of *appropriation work*, mentioned in section 2.1.3, which has to do with people's integration of technology into their work activities and making them work within social and physical contexts.

5.5. Mobile Telephones

5.5.1. Use of Mobile Telephones

The sign shown in *Figure 5- 3* has been and is common in many hospitals. According to Thoresen (2003), the use of mobile phones has been permitted at Rikshospitalet since its inauguration in the year 2000. Other hospitals are following by canceling the prohibition of mobile phones in the hospital area. The reason for not allowing mobile phones in hospitals is due to fear of interference with technical medical equipment. At the IT department at Rikshospitalet, I was told that medical equipment was tested, in advance, for interference with mobile phones. I also learned that most of the hospital had GSM coverage and that such phones were allowed in most of the hospital area.



Figure 5- 3: The 'Mobile Phones Prohibited' Sign, Common in Many Hospitals (Thoresen, 2003)

Although mobile phones are allowed at Rikshospitalet, the hospital does not have any laid down routines on or practices for using them in daily work. From the interviews I carried out, I learned that many people carried mobile phones, but these were usually their private ones. Some people used them for private purposes only, e.g. to get in touch with family members in breaks during the work day, while some used their private phones in a professional setting.

The only ones here that actually use mobile phones in particular are mostly new assistant physicians and substitute physicians, who do not have their own calling. Because we are dependent on getting hold of people who are walking around here, mobile phones are used for this purpose (echo technician).

The echo technician also mentioned that in areas such as intensive care units, however, mobile phones are still prohibited. Here it is documented that some of the equipment reacts to aerial radiation, and these hospital units contain much critical equipment such as respirators.

The patient coordinator, the assistant leader, and also the communication consultant that I talked to made me aware of the fact that the staff at BNS used to have mobile phones before they moved from another institution to the present location at BKL about six months ago. When the switchboard at the old location one day suddenly collapsed, all the employees got equipped with mobile phones instead of fixed telephones. A professional telephone subscription, called *ProffNett*¹, was purchased and used as a mobile switchboard system; and a split billing system was adopted. Phone calls made during the day were paid by the employer, while the end-users paid the rest of the usage themselves. Although this arrangement was canceled after the relocation, some kept their mobiles as private phones. According to the assistant leader, they can still use the mobiles for making phone calls to internal telephone numbers in the hospital if they want to.

5.5.2. Opinions on Today's Situation and Future Improvements

Mobile Phones for Professional Use:

When mobile phones were introduced as work phones for the employees of BNS after the collapse of the switchboard system at the former location, the new solution was welcomed differently. Some of the employees were skeptical of switching from fixed telephones at their desks to mobile phones, but found some of the new features practical after all.

I have to admit that in the beginning I thought, why should I carry that phone all the time? Because I had my fixed telephone at my desk, and there it was. But then you could decide. If I didn't want to, I didn't have to bring it. Still it had voice mail functionality, and I could call back. And I could see who had tried to call and when they had called (assistant leader).

Others, however, did not think much of having to use mobile phones instead of the regular office phones at all. The patient coordinator explains why she did not like it very much.

I thought that was a very bad solution. Absolutely terrible. [...] First of all I think the sound quality is poor, and I don't want to sit with that radiation close to my ear all day. I find it much better to sit down with a fixed telephone ... The topics people call me about I cannot answer when I am walking in the corridor, I answer those when I am sitting in an office in front of a computer screen ... So I was very dissatisfied ... And I don't like to disturb people when they are treating patients.

¹ Mobile subscription from Telenor: <http://www.telenor.no/bedrift/produkter/mobil/proffnett.html>

When you are engaged with patient treatment, you should not be available for answering phone calls (patient coordinator).

The problem of mobile phones disturbing patient treatment was elaborated by the nurse I talked to. When I asked her if she wanted to carry a mobile phone, she said, “yes, or maybe the physicians could have had mobile phones.” She told about how mobile phones were used by physicians at a hospital in Finland when she had practice at a similar ward there.

[...] All the physicians there had mobile phones, so it was very easy to get in contact with them. However, it was a problem during patient rounds; they were ringing all the time. In that case they have to be switched off or in silent mode or something. This led to some chaos, of course, but it was easy [...] for nurses to get in contact with a physician when he had a mobile and not a calling system ... or ... that it beeps in the pocket (nurse).

As mentioned in the previous section, it was decided to cancel the mobile phone subscriptions after the relocation for those who had it, except for some individuals who wanted to keep their subscription. The assistant leader lists two possible reasons why the arrangement was officially revoked and not extended to other employees.

This had to do with money because it is an additional cost if all employees should be equipped with their own mobile phone. And then you can ask how adequate it is that you should be available on the phone all the time while at work (assistant leader).

The communication consultant thought having a mobile phone arrangement could be advantageous for several reasons, compared to alternative communication technologies such as pagers mentioned in the following subchapter. First of all, “it is smarter because you have a mobile phone that you can use in silent mode, and you can receive messages and do all that.” As opposed to the assistant leader who assumed an additional cost, the communication consultant meant that “it is unbelievably much cheaper” than other alternatives; and of this reasons he wanted to hold on to such a solution as much as possible.

Use of Private Mobile Phones:

In addition to those ten people or so that kept their ProffNett subscription, a lot of the hospital employees bring their private mobile phones in order to be reached during the work day. This is, however, not part of the hospital's official communication strategy; so the phones are used mostly to receive calls. “But then you have to ... you are dependent on others knowing your phone number because it is not listed in phone directories etc” (communication consultant).

As mentioned above, others use their mobile phones for private calls only, such as illustrated by the echo technician. When asked if he gave out his number to people at the hospital, he replied, “Not at all. It is used solely for family members to reach me [...] I leave it at the desk when I am out at the wards.” Many seem, however, to carry a phone all day in all types of situations; and it is not always that popular. “There are a lot of mobile phones present at meetings. It often results in a lot of interruption” (communication consultant). The assistant leader found it practical to carry a mobile phone, but “the drawback is that they are

interruptive in meetings and similar situations.” Despite some negative aspects, the head nurse mentioned that it sometimes could be favorable with mobile phones during meetings too.

Yes, and then you can say that I am attending a meeting and am away until then, but call me on the mobile or send me an SMS if anyone has to. And I think that works well, but it is just in cases where something has to be clarified. So the mobile phone has made things a bit easier around here when it comes to getting hold of people [...] (head nurse).

5.6. Pager Calling System

5.6.1. Use of Pager Calling System

The widely used and probably the most important communication technology at the hospital, perhaps besides telephones, is the pager calling system. This system consists of small, simple pagers carried by physicians, some head nurses, and some other individual persons or roles. Each pager has its own telephone number and can be called from regular telephones. If someone needs to get in hold of e.g. a physician and does not know where to find the person, a call can be made to the pager's phone number. The pager will then produce a short sound signal, or a “beep”; and the number of the calling phone is shown in a small display. When it comes to the specific type of pager used at Rikshospitalet, it is a small, white pager with a single lined numerical display and a small red button. The display and the button are placed on top of the pager; so it is not necessary for a physician to take it out of the breast pocket of his uniform, when he receives a call, in order to see the caller's number or turn off the sound signal. *Figure 5- 4* shows the design of a pager similar to the one used at Rikshospitalet, with a single lined numerical display on top and a clip for attaching it to the pocket of a uniform.



Figure 5- 4: Physicians, Some Head Nurses, and Some Others Carry Pagers (Image from iStockphoto¹)

¹ Illustration photo from iStockphoto:

http://www1.istockphoto.com/file_thumbview_approve/967953/2/istockphoto_967953_on_call_tonight.jpg

When someone receives a call on the pager, they have to check the display and use a telephone to call back to the caller's number in order to find out what the request is all about. Due to the somewhat limited functionality with only numerical display, it is not possible to know the reason for being paged, just the telephone number it is called from; and it is used for various purposes. My limited observations indicated that physicians were called in all kinds of situations, from meetings to lunch breaks. Without regard to the setting they were in at the moment they were paged, they called back from a telephone in the room they were in, as soon as they could; or they left the current location in order to find the nearest telephone. However, as a statement from the echo technician mentioned in the following section shows, it is not always the case that physicians with pagers call back right away. This is confirmed by Scholl et al. (2007) who mention that it is common for physicians sometimes to refuse or delay response to a page, especially when meeting with patients.

5.6.2. Opinions on Today's Situation and Future Improvements

It is a common opinion that the pager calling system has been and still is a widespread part of the systems for human-to-human communication at the hospital. Most hospital workers seem to be accustomed to this incorporated communication routine. Due to different professions and the fact that pagers are carried exclusively by particular groups and individuals, however, there are different views on the value of using such as system.

Rigid and Old-Fashioned System:

Some of the people that held administrative positions at the clinic expressed their opinions on the cumbersome method of contacting individuals through paging. The office manager made it clear that "when it [the pager] beeps, you have to go somewhere and make a phone call and call the person back instead of just saying 'hello'." She elaborated this by making a statement of how rigid she thought this system was and what she would have wanted instead.

Yes, actually we have a sort of rigid system, I think, because we cannot call somebody at a pager. We have to dial a number, and then the person ... and then we have to hang up; and then the person has to call us back. So it is no use ... so it should be almost like a phone or as a mobile phone, you see. So you can get hold of people everywhere. So I think it is a somewhat inconvenient system (office manager).

The communication consultant also doubted the usefulness of keeping the old and established calling system, but he was uncertain if it was possible to replace it with alternative systems. Regarding today's system he said, "That part I think is shockingly old-fashioned. But are we able to change it ...? I mean ... the pager calling system is deep-rooted into the hospital, and I cannot see the point of that. So, I really think that this system is old-fashioned."

Interruptions and Prioritizing:

Despite the shortcomings of this technology and a wish for improved solutions, the communication consultant had to admit that the system usually worked as it should. "On the other hand, you get hold of the physicians. It is kind of a cultural thing that if the pager beeps, you call back. I do not think that I have ever seen a physician just turning the calling off." I also overheard a conversation between a couple of nurses in the corridor; and one of them

stated clearly, "The physicians are good at calling back when they are paged. It is, after all, a reason that we need to speak to them."

People belonging to professions using pagers on a daily basis seemed to have gotten used to them and characterized them as an important part of their communication routines. The echo technician confirmed this by saying, "Yes, I am completely dependent on that. We change the daily plan all the time [...] so in a way I am controlled by the use of calling." However, he did not agree to the contention that everybody always responded immediately to a paging call. He addressed some problems regarding the use of paging.

It is, however, one problem because some of the physicians are so sought after that they do not answer the calling if they think they have more important things to do. Then you have to know that, in a way, it is a limited value to page them. They often do not respond. [...] They see which number it is called from, and many filter perhaps a bit there. Plus, another problem of calling use is that there are very few public available telephones at the hospital ... If you are out walking in the hospital, it can be quite far to the nearest telephone [...] In regular corridors there are very few. You may have to walk a couple of minutes before you find a telephone in order to respond to a calling (echo technician).

Interruptions are probably the biggest problem with the use of a pager calling system, and this was mentioned by almost everybody when discussing calling practices. Because it is not possible for the caller to know what the paged person is up to, all types of situations are at the risk of being interrupted; and this might be stressful.

Yes, the pager calling system itself functions satisfactorily, but what is a nightmare are the constant interruptions ... yes, actually several times during a work task you are interrupted. Sometimes the time for patients can be rather short, and when you do paperwork, study diseases ... well, regardless of what it is, you are constantly interrupted. You are sort of never off duty (physician).

The problem that you do not know what the call is about causes "that you have to break off from every setting in order to take a phone call and check. And if you have bothered to take the call, you do not say, let's take that some other time, you discuss a little" (communication consultant). Additionally, paging is used for almost every occasion. "[...] So you have no idea what it is about. It could be a child critically ill, lying with cramps in the ward; and it could be a colleague who wants to have lunch with you" (physician). Hence, due to the interruptive nature of calling pagers, it is necessary to consider the importance of contacting treating personnel.

If you call or page someone, it implies that it is expected that the reason you have is so important that they should abort their contact with patients. That is, calling means discontinuing work activities and talk to me instead. So you have to consider if it is necessary to actually do that (echo technician).

Integration:

When someone tries to get in contact with a physician or another person carrying a pager, they usually try to call the person first. If the phone call is not answered, calling the pager is

the next attempt. Due to this strategy, the process of contacting people consists of several systems, phone numbers, and dialing attempts.

Then you check both the office ... and I know that a lot people are trying to call me ... they first call the office, and especially if they want to discuss things. But then, next thing, they page me. So if I am unable to answer the phone in time, then the pager calling comes too. Then it beeps and rings both here and there (section chief physician).

Further, the section chief physician wished for a somewhat tighter integration of the existing systems in order to reduce the number of calling attempts, and he mentioned a solution in use at other hospitals.

And you could imagine that, as is actually done some places, if you call a person, you call the office; and then, next, you are forwarded to the pager. We do not have that system, they have it at Ullevål [University Hospital] among other places, and for those who actually have turned it on—quite a lot of people have not done it, obviously—it is easier to reach that person (section chief physician).

I also asked the regular physician if he had other opinions regarding the use of the calling system; and he said, "I suppose it is generally agreed upon the fact that it works with calling and that it is wonderful to be able to hand it over after a work day—that the duty sort of ends when the calling is handed over."

5.7. Nurse Calling System

5.7.1. Use of Nurse Calling System

Another type of calling system is used in order to call nurses who do not carry their own pagers. Nurses spend most of their time somewhere in the ward in which they are stationed; and hence, the calling system is installed in the corridors and patient rooms in the ward. The system consists of electronic boards hanging in the ceiling of the corridors, and one or more boards are always visible from every location inside the ward. As seen in *Figure 5- 5*, the board consists of luminous displays showing numbers and one line enabled to show text. Each nurse is assigned a personal number. If someone needs to contact a nurse and do not know where the person is, they can type in the nurse's personal number. The calling system will then produce a sound signal and the nurse's number is shown in the light displays on the boards. All nurses will then have the opportunity to glance at one of the boards in the corridor ceiling or inside a patient room. If the requested nurse recognizes his or her personal number, he or she goes to the counter to receive the message. At this counter, which functions as the ward's communication hub, there is a control panel for using the calling system. On the wall next to this control panel, there is a notice containing a list of which nurses are assigned which numbers. According to the nurse I talked to, the secretaries often used this calling system when a physician or another nurse could not find a specific nurse and asked at the counter. The secretaries would then type in the nurse's number on the control panel and wait for the nurse to come to the counter.

The nurse calling system is integrated in a patient annunciator system. If a patient wants to call the nurses' attention, a button inside the patient room will be pushed. This results in a sound signal and the boards in the ceiling showing the room number from which the call was initiated. If more than one call is triggered simultaneously, the room or nurse numbers will be shown in the light displays in an alternating fashion.



Figure 5- 5: Nurse Calling System with Electronic Boards in the Ceiling (Haug et al., 2004)

5.7.2. Opinions on Today's Situation and Future Improvements

Due to the fact that regular nurses do not carry pagers when they are around, other ways of contacting them are necessary. The head nurse explained how the nurse calling system could be used for calling nurses with their personal numbers, and she thought the system was a good solution. "It is at least a small assistance when trying to get hold of people", she said.

For the secretaries at the counter, the calling system was a much used technique for finding nurses. One of the secretaries thought this kind of system worked well for nurses due to the fact that they spent much time in the ward and that they could see the light boards in the corridors and all rooms. Physicians, however, were more "here and there"; and she therefore thought pagers were more suitable for them.

The regular nurse was not so certain that the nurse calling system was an ideal system. She expressed, "[...] I do not think it is a very practical system. It may ring for a long time before you notice that you are being called." She came up with an idea of the possibility of having another type of calling system, using loudspeakers to call for individuals in the corridors and all rooms in the ward. This idea was also based on a solution from a Finnish hospital, where they used the system to give oral messages about waiting phone calls etc. The nurse did, however, see the problem of possible chaos or noise with loudspeakers in every room, but anyway she said, "[...] I thought it was very practical, and I heard all the messages [...] so that could have been a possibility."

The physician thought the nurse calling system was an okay arrangement, and he used it now and then. "Sometimes I use it in order to get hold of nurses, not very often, perhaps once a week. Searching is also a widely used technique. I spend a lot of time doing that; searching for nurses" (physician).

5.8. Other Types of Communication

5.8.1. Use of Other Communication Applications

Communication through Information Systems:

In addition to the types of communication mentioned in the preceding subchapters, there are some other ways and applications for communication as well. Some of these relate more to information systems than typical human-to-human communication tools such as telephone and e-mail. There is an abundance of different information systems, ranging from administrative and personnel applications to medical records and clinical systems. An intranet portal called *My Desktop*¹, shown in *Figure 5- 6*, is used by all hospital employees as an information channel for universal messages to groups of people. Information relevant for the entire hospital or specific sections can be read by logging in to this web portal, and it is often used to publish information instead of sending e-mails to mailing lists. The contents of information and services are adjusted to the individual user.

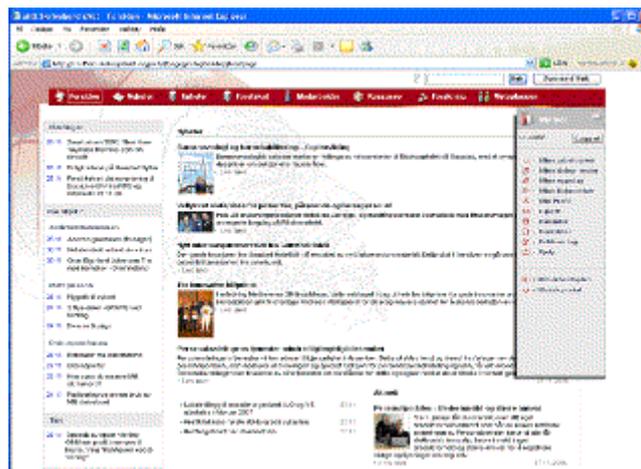


Figure 5- 6: “My Desktop” is an Intranet Portal with Individually Adjusted Contents (Ill.: e-Vita²)

Communication and Coordination:

Communication between people working in a hospital is often linked to coordination. Some coordination is supported by schedules of where people are supposed to be at all times. These schedules can be handwritten lists on paper or whiteboards, but they can also be electronic calendar applications. The patient coordinator’s work tasks are—obviously—based on coordination. She uses a *Microsoft Word*-based resource coordination tool when planning patient treatment. This system is a manual and relatively primitive tool that she has developed herself. It contains lists and tables of patients and resources such as physicians and other professionals and a calendar functionality of when they are available. Those people who has

¹ In Norwegian: *Mitt Skrivebord*

² e-Vita: www.evita.no

responsibility for treating a specific patient have read-only access to these Word files, and they can copy and print information from these through macros in Word. Hence, the patient coordinator finds and communicates with her colleagues through this Word-based resource tool.

The above mentioned system is also combined with coordination through shared folders in *Microsoft Outlook*. Every patient's first appointment with the physician is entered into calendar functionality in shared folders in Outlook. In this way all the treating professionals can check this information, coordinate activities, and update their own calendars.

In addition to technologic communication applications, there exist manual, simple ways of ad-hoc communication and message exchange. Oral message delivery was used on a large scale. Another such technique that is utilized at the hospital is the familiar yellow post-it note. These notes were used in order to leave brief messages about e.g. patient activities that had to be carried out or phone numbers and people to call. During my observations I witnessed an episode where a nurse went by the counter and received a written note about patient-related matters from one of the secretaries, to which she sighed, "I'll do it when I get time to spare."

Yellow notes with explanatory information were sometimes also attached to written documents. When I spent some time at the counter, I e.g. discovered an epicrisis lying on the desk with a post-it note attached to it. The note was marked "urgent!", dated, and signed by a section chief physician from another hospital. Yellow post-it notes with all sorts of small comments were also in great numbers next to the computers and telephones at the counter.

5.8.2. Opinions on Today's Situation and Future Improvements

The communication consultant talked about the development of communication and coordination in hospitals. He stressed the difference between information and communication. "Information is one thing, communication is the more difficult part, where information is read or understood or dealt with." In the previous section the use of shared folders and calendar functionality in Outlook for coordination was mentioned, and the communication consultant had this to say about that tool:

[...] You can create shared folders for calendar and days, right. And then people have to register when they are busy. Never works because you are totally dependent on everyone's using of the calendar in Outlook, and not in their own folders, but in shared folders. And those who already use their own folders for registering where they are that day have to use double-entry. So it is never used. So it has to be some sort of an integrated feature. If you register one place, it is registered; and other people can find it (communication consultant).

The resource planning tool used by the patient coordinator is vital in her work, but she thought it was somewhat primitive. She explained, "I have had many attempts trying to get a better system, but existing systems are not well arranged enough to provide that help and overview I want. So it is actually quite frustrating." Still, her system can be said to be relatively advanced compared to similar systems at other wards where they use paper-based coordination systems.

Integration of ICT Systems:

As mentioned in section 5.3.2, it sometimes could be a problem with a lot of e-mails sent to several people. The head nurse said that she received this kind of e-mails from her superiors and the hospital management.

But I think the hospital now publishes a lot on "My Desktop", so you don't get everything in your mailbox. It means a lot that the hospital management finds its homepage instead of bombing the mailbox with all sorts of things (head nurse).

In this way the intranet portal has taken over some of the load from information sharing through e-mail. One thing that several of the hospital workers passed remarks on, however, is the abundance of different applications and systems at the hospital, as was mentioned in the previous section. And the fact that many of these do not communicate with each other was felt like an extra strain during the work day. "So, communication between the different systems would have been of great help", according to the head nurse. She would appreciate the possibility of swapping between systems and moving information easily from one system to the other. One of the problems regarding the use of many different systems "[...] is a simple thing such as passwords. I wish I had the same password on every system. I had that once, but that is a project I have given up", said the assistant leader. Further she expressed, "If the IT department for instance knew that I changed my password there, then it could propagate to other systems. That would have been nice, and I think perhaps I would be better at changing my password." This opinion was supported by the nurse who also thought that a tighter integration between ICT systems would be desirable.

Yes, I think so. There are both the personnel portal and My Desktop, or whatever it is called, [...] where you need separate passwords. But there are many of the same things occurring in the two portals. So why do we have two of the same? I don't understand it (nurse).

In addition to existing systems, new ones were frequently introduced. Also people employed in administrative positions thought there were too many different systems at the hospital.

What I think is difficult at Rikshospitalet is that we always get a lot of new systems; in large numbers, all the time. And then the systems often do not talk to each other. I think that is difficult. When someone gets out of their job at the hospital for instance, there are numerous systems that have to be told that the person is quitting (office manager).

6. DISCUSSION

This chapter opens with a discussion of how today's system for human-to-human communication could be improved in future systems, which changes and additions would be desirable, and how much integration of various functionality would be feasible. Then it discusses diversity of needs and opinions between different professions at the hospital and important aspects of introducing new systems, such as usability, user-friendliness, security, and robustness. Some thoughts on involvement of users in the process of system development conclude the discussion chapter.

6.1. Possible Changes, Improvements, and Integration

A retrospective Australian survey of hospital admissions found that communication problems were the most common cause of preventable disability or death, and were nearly twice as common as those due to inadequate medical skill (Coiera and Tombs, 1998, p. 673).

As the statement above clearly illustrates, it is extremely important with proper communication routines and practices in hospital work. The results of my research indicate that several of the hospital workers consider some of today's practices for human-to-human communication as ineffective and that improvements would be desirable. A lot of valuable time is spent trying to look up or contact people due to the size and complexity of the hospital organization and the number of employees. Not only are there many hospital workers, but they are dispersed over various profession, roles, and functions. Additionally, they move between several locations during the work day.

Scholl et al. (2007) also claim that the limited functionality of the much used pager system suggests that text and voice messaging would be beneficial in future solutions. They mention benefits such as "[...] ability to discern information about the urgency and origin of pages, making it possible to contact other staff members directly without needing to locate landline phones, and making it easier to quickly inform others about their communication availability [...]" (Ibid.).

Another key characteristic of paging, in addition to the limited functionality of the pager, is the interruptive nature of the communication. It seemed that most of the hospital workers agreed on the problem of interruptions when using paging, and that they would prefer alternative ways of contacting patient treating personnel. With context-awareness integrated into a multifunctional communication system, it would be possible for the caller to assess the importance of a message and choose when and how to deliver it to the receiver, based on knowledge of the context. Information about context could be based on location from a positioning technology and presence and availability from a calendar application or dynamic addressbook. Some possible solutions and technologies for integrating such functionality are presented in Appendix A.

When the hospital workers talked about integration between systems, most of these systems can be characterized as information systems rather than systems for human-to-human communication. During the interviews I presented to them the idea of a context-aware,

integrated system, as mentioned above, and wanted to know what they thought about such a solution. I explained the possibility of having multifunctional handheld terminals and using context information in order to choose a proper way of communicating in different situations. Several of the people I asked thought this could be a possible solution.

Yes, in many ways I think so. Because you would also have ... because when the physicians have calling, it is a very disturbing element on patient rounds. And I know that the physicians think—I shall let them speak for themselves—but with a small text message they could say that this is something I can actually put off until I am finished with this patient [...] (head nurse).

She emphasized the size of the hospital and that people could be everywhere. So did the assistant leader, and she liked the idea of being able to send text messages in some cases. “Yes, a brief text message or something similar. I would anticipate that those answering phone calls at the counter, for instance, would benefit from such a possibility of forwarding a message.” Further she explained why she thought location indication was a fascinating idea, “Informal meetings are something we seek how to accomplish. Hence, it was a captivating thought with something of the sort of GPS.” The communication consultant thought that most physicians would not mind using such a system. “It is simply a necessary aid in their job, and then I think ... if it can be better than what we have today, I think they would ... except for a few quarrelers who ... there will always be someone that is against it.” The echo technician is not one of them. He thought it would be a nice thing, and he already uses a PDA in his work, which he is dependent on. “And, extending it with GPS or something similar ... that should be a simple matter. Everybody is going to need access to always more information, and we know that. So why not utilize it?”

Others, however, were a bit more skeptical of this kind of functionality. For instance the patient coordinator did not see the use she would have of such a system. “But I do not only have a computer screen, I have papers beside. So I cannot wander around with a machine and answer things in the corridors.” She usually knows where people are, and she would prefer to keep it simple and have flexibility.

I think that ... what you say about too much integration [in information systems] leading to additional work, I agree to. It gets too advanced and too over-complex. What happens then is that everybody sits with paper-based systems beside; paper and pencil beside. [...] And if all that is to be integrated in a technical system, it will not work. There are needs for flexibility (patient coordinator).

The nurse was not sure if introducing new technologies would achieve a great acceptance among the majority of nurses and other employees.

Eh ... something similar to GPS? Eh ... I don't know. Maybe it gets ... I don't know ... could we have time to ...? If you have to go through several ... now we have so much to deal with when it comes to computers and a lot of different passwords, so it starts to get a bit tiresome. Because if we get even more, I think that everybody would get a bit tired (nurse).

Privacy aspects of such solutions were also considered. “Yes, of course, someone will always know where you are. At work is one thing, private is something else” (assistant leader). The

echo technician could imagine that “[...] some would probably experience a withdrawal when demands are made on their command of technology. But that is just the way it is.” He mentions that necessary computer skills are just as important as patient-related skills. “If you cannot manage it, you’ll have to find something else to do. It is as brutal as that”, he said. The problem of privacy regarding location awareness can, according to the echo technician, be solved through written agreements, similar to which doors keep track of which people passing through them with access cards. This discussion highlights the fact that system configuration requires changes in not only technology, but the environment surrounding it, as mentioned in section 2.1.3 about appropriation work. Users have to integrate and adapt the use of new technology into their work activities.

Also the physician had his doubts about introducing an integrated communication system. He thought that in a system with so much human-to-human work, i.e. patient work, there is too much unpredictability and not a good idea to put too much technology on the way you communicate with people. “It would be hard to get rid of the calling system”, he thought. He also said, “In such a system, you will very easily state that you are busy and make yourself unavailable if you can. It will be judgment anyway.” This could be a problem if presence information is set manually, and perhaps automatic presence updates based on context information would be necessary. The physician admitted that sometimes it could be practical to send a text message, but he mentioned possible problems relating to user-friendliness of handheld devices. This is explained further in subchapter 6.3.

Another important aspect mentioned by the physician was that his colleagues probably would want to assess the importance of a message themselves. “Well, imagine that a nurse regards a message as non-urgent; and then it actually was. Then the responsible physician probably would have wanted to have the opportunity to make that judgment himself.” This problem has to do with apportionment of liability. If e.g. a nurse or a secretary has to consider the importance of a message and the context of the receiving physician and then has to decide how to forward it, misunderstandings and mistakes could arise. The physician thought that non-systemized communication sometimes could be better and that it could be advantageous to place the assessment of a situation at the intended receiver of the information as quickly as possible. Ellingsen and Monteiro (2005, p. 271) explain how simplification for somebody can produce additional work for others in integration of information systems. “The overall level of order and disorder, however, appears to be largely constant” (Ibid., p. 272). Perhaps this could have the same effect in an integrated communication system, just relocating workload and decision-making from one profession to another (e.g. from physicians to nurses and secretaries) instead of improving the effectiveness of patient treatment.

On the other hand, an integrated system could make it easier to document the communication that actually has taken place. This could be relevant in the case of medical malpractice suits. With today’s practice it would be difficult to produce evidence for how the communication in a specific situation has happened, with pages, phone calls, and oral messages in all directions. The echo technician mentioned that he wanted more documentation of the decision-making processes in relation to examinations and operations. This could make it easier to further evaluate the examinations and the communication afterwards.

As some of the hospital workers mentioned, they used today’s e-mail system as much as possible of that very same reason; they wanted to archive their conversations in order to be able to document their work. The problem of e-mail is the restriction in discussing patient

information. For clinicians it would, therefore, be interesting to consider other solutions for asynchronous communication and sharing of patient information. This could be integrated in a system together with functionality for synchronous communication and context-awareness.

Although some changes are desired and in the longer term probably necessary for hospital communication, the existing solutions are probably not that easy to alter. As many of the hospital workers passed remarks on, it seemed that it was a common opinion that the pager calling system is actually working and that its users are accustomed to it. The technology is deep-rooted into the hospital communication routines and is probably hard to replace. The chief section physician had no doubt that there will be changes in hospital routines and that it most certainly will go in the direction of modernization and digitalization. He mentioned, though, development processes at other Norwegian hospitals, such as *St. Olavs Hospital* and the new *Ahus*, and that they had problems getting things work.

The communication consultant said that it was his job to develop strategies for new communication routines and practices. Although the hospital is a relatively new building, he stated that it was a really old organization with old fundamental attitudes and routines. "It is a very big ship to turn and even a big ship just to swing a little now and then. So it has to be done gradually" (communication consultant). Groth is of the same opinion and states (1999, p. 386) that the hospitals are extremely difficult to change due to their very rigid organization. If the communication consultant is right about physicians being a group of individualists and often doing what they want, it could be a challenge to lay down new strategies for communication and use of new technology. Common strategies are hard to make if not everybody wants to use new technology or uses it differently. The value of introducing new systems would then decrease. Some may feel overburdened or alienated by new technologies and advanced systems, and "pulling the plug" could be the only way of coping with communication overload and changes. Several of the interviewed hospital staff members thought in general that too much technology in hospital communication is not the answer; and flexibility, simple systems, and time to see other people are more important. Hence, it is necessary to find the right balance in digitalizing and changing communication routines. With a variety of professions with their own traditions and incorporated ways of doing things, hospitals can never change dramatically. "Actually, the *professional bureaucracy* is probably the configuration where information [and communication] technology provides the most limited platform for change" (Groth, 1999, p. 387). ICT can never replace the professionals and their professional judgment, but the efficiency and quality of work tasks can be somewhat improved (Ibid.), and some integration and development in systems for human-to-human communication should be feasible.

The hospital consists of different types of wards and departments, and the needs for communication could vary depending on the type of patient treatment carried out. E.g. the Children Neurological section is following up diagnosed patients during a longer time perspective than normal bed wards. Hence, the patient treatment is characterized more by temporal trajectories, as explained in section 2.1.6, while rhythms control the daily work in hectic wards with a high patient-turnover and "short" patient case histories. Additionally, hospital staff constitutes a variety of professions and roles. The diversity in needs and opinions between professions is discussed next.

6.2. Different Professions and Different Opinions

Due to the diversity of different professions and people working in a hospital, there are also different opinions on and needs for communication solutions. When it comes to thoughts about the systems used for human-to-human communication in today's practice, it appeared to be a slight difference between people in administrative positions and clinical personnel. Administrative and office personnel, who need to contact physicians and nurses several times during the day, seemed to be of the opinion that today's routines and technologies were somewhat cumbersome and rigid. This applies primarily to the hospital's incorporated pager calling system, which was looked upon as relatively old-fashioned. Administrative people would probably be more inclined to welcome a more integrated communication system, in which they could locate clinicians more easily and choose the most appropriate way of communication, based on the context. It is probably easier for them to accept an integrated system that makes it easier to locate and contact clinicians, without having to be monitored themselves. Additionally, administrative and office personnel spend much of their time in front of a computer; and it would probably be easier to manage new applications with added functionality on a desktop computer with a big screen, than on a small handheld device.

My research results indicate, however, that clinical personnel, such as the nurse and the physician I interviewed, tended to be a bit more skeptical of an integrated, context-aware system, than the administrative and office personnel. The nurse, for instance, remarked that they already had so many systems to deal with and that too much new functionality could be too much for somebody. New communication equipment therefore has to replace rather than complement existing devices in order to avoid overloading the clinicians with communication equipment. Scholl et al. (2007) also argue that a single device with different services would be advantageous. The physician was skeptical of too much technology for human-to-human communication, and he and others emphasized the importance of having room for flexibility in unpredictable, stressful, and skill-intensive medical work.

Privacy aspects of such a system would be more relevant to discuss for clinical professions. A system like this could monitor their work activities, and people would know about their whereabouts and availability all the time. This could be a reason why these mobile professional groups tended to be more unconvinced than office personnel, of the benefits of integrating a lot of functionality. It could also be different opinions and conflicts between clinical professions. Wagner (1993, p. 95) claims, for instance, that nurses could find it attractive to indicate their availability, whereas surgeons could be interested in keeping parts of their calendars less transparent to others. Recall the physician's statement, from the previous subchapter, about physicians making themselves occupied if they have the opportunity to state their availability manually in an integrated system.

As opposed to office personnel, clinicians would have to carry some sort of a handheld device in a context-aware, integrated communication system due to the fact that they are moving around in their work instead of sitting in an office with access to a desktop computer. This could be another reason why there could be differences between professions. A handheld device would have other characteristics and limitations compared to desktop computers, and usability and user-friendliness will among other things be discussed in the following subchapter.

6.3. Usability, User-Friendliness, Security, and Robustness

If the clinicians were to carry a multifunctional handheld device for all types of human-to-human communication, various aspects must be taken into considerations. Information security and privacy issues would be important. It would be necessary with an internal system, and information should not be transferred in public networks such as the networks of mobile operators. My contact at the IT department claimed that the body of laws sometimes could be a challenge when developing new ICT systems. Patient information would also be more exposed to persons not concerned with the treatment of that specific patient. In today's routines patient information is usually discussed face-to-face in closed offices and meeting rooms or over the phone from relatively secure places. Using handheld devices with the possibility of voice communication, treating personnel is likely to discuss patient-related matters when walking in corridors and other crowded places. The likelihood that someone overhears information they should not have access to therefore increases. Even with some integration of today's information systems, it is possible to gain access to too much patient information. The assistant leader thought that with a person's social security number, you could easily access a lot of patient information. "[...] I am afraid that I could come into a lot of places if I tried to enter" (assistant leader).

Although the clinicians seemed to be somewhat uncertain about new solutions, they understood the usefulness of having the possibility to choose alternative ways of communication. As mentioned in the previous subchapter, the physician admitted that it in some situations could be practical to have the possibility of sending a text message, but mostly for less important functions such as making lunch appointments. He mentioned, though, possible problems related to typing. "I type very quickly, but everybody does not do that. So then you would have to give them some time, maybe, so they would get used to it. Or you could imagine keyboards that are easier to use" (physician). Compared to desktop computers, handheld devices will also have other limitations that have to be taken into consideration, related to factors such as screen size, processing power, storage capabilities, and power consumption, to mention some. Weaknesses in communication equipment could result in a sensation of communication deficiency, described in section 2.1.5, with desired communication through undesired or insufficient modes of communication.

As far as introduction of new systems is concerned, the chief section physician argues that the skepticism lies in protection of personal information and the robustness of the systems. In a hospital setting, a breakdown is out of the question; and backup systems are necessary. If much functionality is integrated into one single system and the system breaks down, then everything stops. Winthereik and Vikkelsø (2005, p. 60) mention that "[o]ther analyses have pointed to the way ICT may also hinder the accomplishment of medical tasks." Balka and Wagner (2006) describe the introduction of an integrated wireless call system into a hospital; and "[t]hree weeks into the pilot, the phones suddenly stopped working during a night shift" (Ibid., p. 232). The staff then had to resume the work activities with the older call system. A head nurse at the mentioned hospital said, "Good thing we kept the old system in place" (Ibid.). When different systems are in use, you are able to pull through such a situation nevertheless; and fixed telephones and pagers have proven to be relatively robust communication systems. The communication consultant also mentioned the balance between system development and functioning in daily work. He argued that many ICT people are only interested in developing new functionality, whereas he also had a focus on actually making things function in everyday use.

6.4. System Development and User Involvement

When I discussed the possibility of introducing new ICT systems at the hospital, some of the employees had opinions on aspects regarding system development. Many of them mentioned the importance of user involvement during such processes.

I think that a part of the software that I[C]T people sit around and develop for the hospitals perhaps should have included more users in the actual process where you bring forward the systems. I am sure they are fine, but they are not always adjusted to those who are going to use them ... Then you would experience less frustration and refusal among the users because a lot of people say, "oh! I have no effort ..." (assistant leader).

When people get frustrated over information and communication systems they do not think provide the desired services, they are at risk of "pulling the plug" as was defined in section 2.1.5. The patient coordinator complained about how ICT people look at system development differently than she does. "But those at the IT department who were supposed to help me with that some time ago, they wanted everything in decimals and everything on automatics, so to speak." Her work activities could not be expressed by decimals and automatic processes. Further she explained, "And I remember that one of them spent maybe half an hour or an hour in my office, and then he thought he could develop, at his desk, the entire system that I have spent years making." She expressed her wish about how systems should be developed. "My dream is to develop such a system with an expert who knows the technical part and is willing to understand which basic criteria and factors I need in such a system. Then I think it would be really good."

The communication consultant saw it as an advantage that he in his job had just a little higher level of technological knowledge than those people he was supposed to instruct, "[...] because then their questions have been things I can do something about; and still they have not been that trivial that I, as an I[C]T expert, would have gone mad."

My point is just to use the knowledge that others have and try to make it good and not necessarily possess the knowledge myself. And then I am able to cover a somewhat wider range than necessarily be so damn good at it myself [...] (communication consultant).

As the discussion of developing new systems points out, it is necessary to examine the actual needs among different users instead of pushing the same solutions on everybody. It must be considered whether different groups of hospital workers should use the same type of equipment and if the same functionality could cover different professions' needs and requests.

7. CONCLUSION

This thesis has presented theory from ICT research in health care and described the health domain. It has also discussed methodology of qualitative research and described how qualitative research techniques were used in a fieldwork study at Rikshospitalet in order to investigate existing communication routines and possible future improvements. The results from this study and the subsequent discussion of them serve as basis for answering the research questions, listed in section 1.2.1, in this conclusion chapter.

As an outside researcher I was well received at the Children's Clinic at Rikshospitalet and got the chance to get somewhat familiar with work activities and routines. Through my observations, informal talk, and supplementary questions in interviews, I am able to answer the first part of the research questions, relating to today's practice for messaging and use of communication technologies. Various types of communication were in use at the hospital. Face-to-face communication in planned meetings and informal conversations was important and much used for several purposes, both in professional and private settings. E-mail was used as asynchronous communication for all types of messages, but mostly for administrative purposes due to regulations of treating patient information. Messages to clinical personnel were primarily given verbally or through paging and phone calls. Physicians and some other individuals from other professions carried pagers and usually called back from a telephone when they were paged. Nurses were mostly contacted by physically finding them or through a nurse calling system with sound signals and numerical displays in the ceiling. In addition to these common communication practices, other more informal types of messaging were used. Many employees carried mobile phones, primarily their private ones; and these were used for private calls, but also some work-related messaging. Written messages, post-it notes, and computer applications were also a part of the abundance of communication and coordination practices among hospital personnel.

The second part of the research questions deal with the hospital workers' opinions on today's systems and practices and possible improvements and integration of systems. Findings from my qualitative research discovered that many hospital employees find some of today's routines and practices for messaging somewhat rigid and cumbersome and that improvements or changes could be desirable. Tighter integration of systems for human-to-human communication could possibly improve the efficiency in some situations, by reducing the time spent trying to find people and choosing appropriate types of communication based on context. However, the effectiveness and quality of the medical work is not necessarily improved because of possible relocation of workload and responsibility. It is important to have room for flexibility in human-to-human related work. Much communication is controlled by hidden responsibility, professional judgment, and knowledge of context. With many different professions, roles, and traditions, it is difficult to find common opinions. At all events a system with more integrated functionality should be possible, such as handheld devices with options of voice, text messages etc. Administrative and office personnel seemed to like the idea of choosing how to contact clinicians. Physicians and nurses seemed to be a bit more skeptical, though, of too much integration, context-awareness, and too much new technology on the way they communicate in clinical work. Technology and communication routines will probably experience future improvements, but the hospital organization is hard and slow to change; and it must be done gradually with small steps. Deep-rooted communication systems such as the paging system are though to get rid of.

8. FURTHER WORK

This study can be seen as a prestudy for further research of development of new systems for human-to-human communication in hospitals. It has not proposed a specific system or technical solution, but rather provided some thoughts and opinions among intended users and important aspects to consider when developing or integrating systems. As Dourish (2006, p. 545) puts it, "Sometimes, after all, the most effective outcome of a study might be to recommend what should *not* be built rather than to recommend what should." Appendix A presents some existing and proposed technologies and possible solutions that could be relevant in further work.

An extension of my work should include a more extensive study of communication routines in hospitals, spending some more time in the field and preferably in different parts of a hospital or more than one hospital. It would be interesting to follow clinicians more closely when they move around at the hospital. If possible, it would also be of interest to study communication practices during patient rounds and perhaps ask patients about their experiences of message exchange between hospital staff members. A more in-depth trace and examination of message flows from sender to receiver should be carried out. This could also preferably be combined with quantitative data from call logs and message archives, which I did not get the opportunity to process in connection with this thesis.

As several of the hospital workers I talked to called attention to, user involvement is important in potential future system development. Hospital workers should be included in the developing process through phases such as planning, design, implementation, and testing. Prototypes of handheld devices and applications could be developed and employed prior to implementing real-life communication systems.

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INDEX

agreement document.....	4; 32
<i>appropriation work</i>	7; 44; 65
<i>articulation work</i>	6
availability.....	14; 38; 55; 67; 74; 75; 76
calendar.....	36; 40; 52; 53; 75
callee.....	iii; 1
calling system.....	42; 46; 47; 48; 49; 50; 51; 57; 58; 59; 63
Case study.....	26
Children's Clinic.....	i; iii; 22; 28; 29; 30; 43
clinicians.....	34; 58; 59; 63; 64; 76
collaboration.....	1; 3; 12; 13; 16; 17
<i>communication deficiency</i>	9; 41
communication overflow.....	9; 40
communication technology.....	i; 4; 5; 8; 19; 40; 47
<i>context-awareness</i>	8; 55; 63; 76
counter.....	30; 33; 42; 43; 50; 51; 53; 56
CSCW.....	viii; 5; 6; 65; 66; 67
digital video recorder.....	37
eHealth.....	viii; 17; 18
EHR.....	viii; 19
e-mail.....	4; 27; 38; 39; 40; 41; 42; 43; 52; 54
EPR.....	iii; viii; 1; 12; 17
Ethnography.....	26
face-to-face communication.....	36; 37; 38; 40
field research.....	iii; 4; 21; 25; 28; 29; 30; 33
field study.....	1; 4; 6; 11; 27
fieldwork.....	5; 10; 13; 25; 28; 29; 35; 63
flexibility.....	iii; 10; 56; 58; 59; 63
general practitioner.....	15
GPS.....	viii; 56
groupware.....	6; 12; 67
GSM.....	viii; 44
handheld terminal.....	76
HDE.....	viii; 31
health care.....	i; iii; 1; 4; 5; 6; 12; 13; 15; 17; 18; 19; 25
human-to-human communication.....	iii; 1; 2; 13; 14; 37; 42; 48; 52; 55; 72
<i>human-to-system communication</i>	iii

ICT iii; 1; 4; 5; 6; 11; 15; 16; 17; 18; 19; 23; 25; 54; 61; 68

informal talk 28; 33; 63

information overload 8; 9

information security iii; 1; 17

information systems iii; 1; 9; 12; 13; 52; 55; 56

integration i; iii; 1; 3; 6; 13; 44; 50; 54; 55; 56; 65

interaction overload 8; 9; 41

interpretive research 13; 26; 68

interruptive 47; 49; 55

interview guide 4; 31; 32

interviews iii; 4; 12; 13; 14; 27; 28; 30; 31; 32; 35; 39; 44; 55

intranet 41; 52; 54

KITH viii; 18; 66

KoKom viii; 19; 66

mailing lists 39; 52

Mediated communication 1

mobile phones 19; 44; 45; 46; 63

morning meeting 36; 38

national health network 17

NSEP viii; 19

NST viii; 18; 19; 67

observations iii; 12; 13; 14; 27; 28; 32; 33; 35; 53

PACS viii; 6; 12; 68

pager 42; 47; 48; 49; 50

password 54

patchworks iii; 1

patient rounds 36; 46; 56; 64

PDA viii; 56

post-it 53; 63

presence 34; 73; 74; 75; 76

privacy iii; 27; 57; 60

professional bureaucracy 20; 58

prototype 73; 76

pulling the plug 8; 58; 61

qualitative research iii; 4; 11; 14; 20; 25; 26; 27

quantitative 4; 13; 25; 27; 33; 64

Regional Health Authority viii; 16; 21

research questions i; 3; 4; 11; 25; 26; 27; 28; 63

research techniques 13; 25; 27; 28; 30; 63

RHA viii; 16

rhythms 10; 11; 36; 67
 Rikshospitalet..... i; iii; 4; 12; 15; 16; 20; 21; 22; 23; 25; 28; 29; 30; 39; 42; 44; 47; 54; 66; 67; 78; 80
 Shared folders40
 social researchi; 27; 28
Te@mwork 2007viii; 16; 17; 18
 telemedicine18
 telephone switchboard33
temporal horizons..... 10; 11
trajectories 10; 58
 user involvementiii; 61; 64
 voice mail 40; 41; 43; 44; 45
 workshop5; 12

APPENDIX A: Possible Technologies and Solutions

This appendix mentions some existing and proposed technologies, conducted work, and possible solutions that could be relevant for an integrated system for human-to-human communication in hospitals.

A.1 Context-Aware Architecture for Hospital Communication

Muñoz et al. (2003) present a context-aware architecture for information management in hospital settings. An illustration of their architecture and the functionality of a context-aware messaging system are shown in *Figure A-1*.

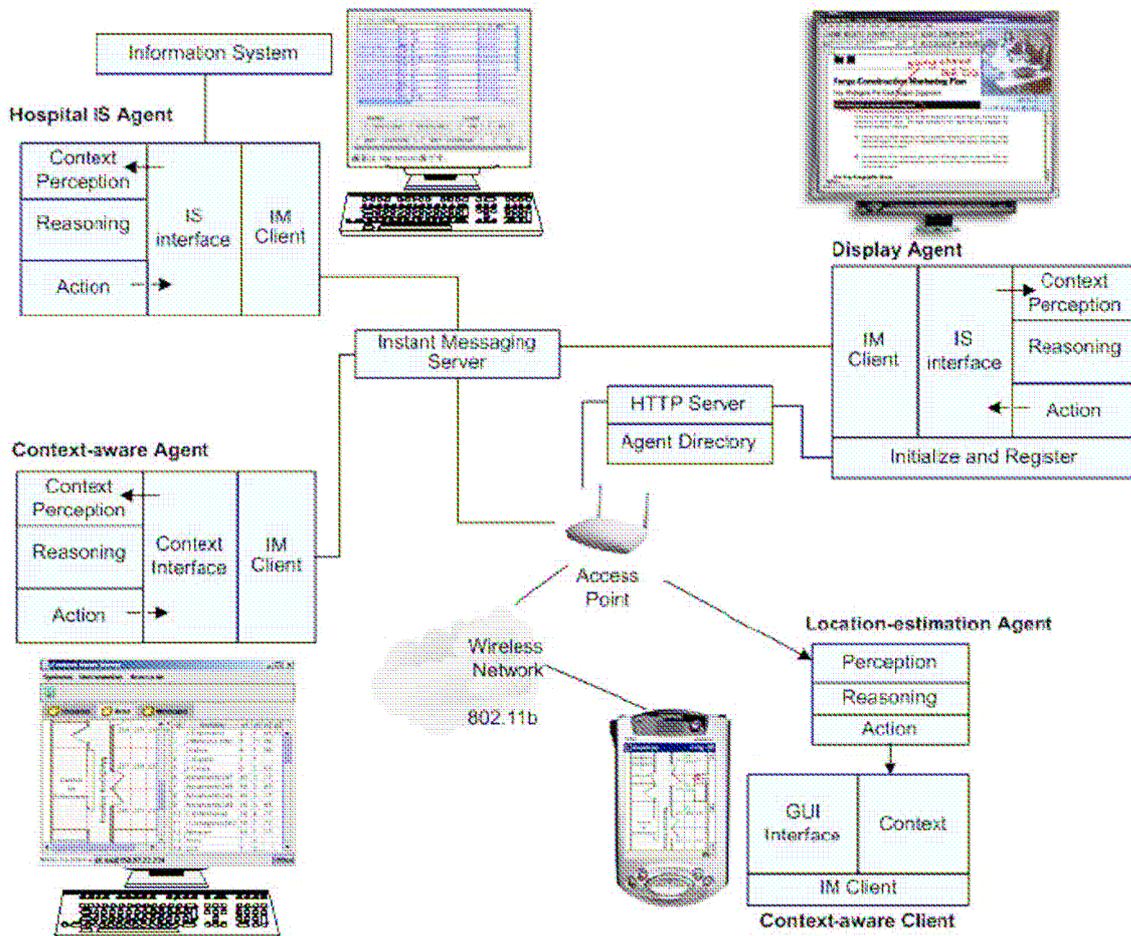


Figure A-1: Architecture of Context-Aware Messaging System (Muñoz et al. 2003)

The architecture consists primarily of following components (Ibid., p. 338–340):

- **Terminal or desktop computer acting as access point:**
The computer is used for accessing networked information and handheld devices through a wireless network and XML/HTML communication. It also contains a directory, to which agents representing services and users register.
- **Instant messaging server:**
This server notifies the state of people and agents and handles interaction among them through XML messaging. Handheld devices synchronize information with this server.
- **Context-aware client:**
The context-aware client consists of two components. One of them is a lightweight GUI for composing messages and specifying context of delivery. This context information is recorded by the context component.
- **Agents:**
The message system consists of several autonomous agents that act on behalf of users, represents devices, and wrap system functionality. The following agents are comprised by the messaging system:
 - Context-aware agent for delivery of context-dependent messages
 - Location-estimation agent that calculates the user's position in the wireless network, based on triangulation of access points.
 - Hospital IS agent for gaining access to and monitoring of the hospital's information system. Based on role and location, hospital staff can get access to patient information.

For a more thorough description of the messaging system functionality, see Muñoz et al. (2003).

A.2 Presence and Availability in Context-Aware Systems

Milewski and Smith (2000) mention a significant problem of telephone communication as lack of awareness about the presence of the callee and consequently interrupting phone calls. They present a prototype of a telephone manager called *live addressbook*, which provides personal presence information about the called person to the caller. A schematic illustration of the system is shown in *figure A-2*. The system consists of components and functionality such as (Ibid., p. 90–91):

- Network-based addressbook
- Click-to-dial calling
- Conferencing-by-default
- Personal Presence Information
 - Availability
 - Location
 - Message
- Overhead reduction
- Ubiquitous, multiple-device access

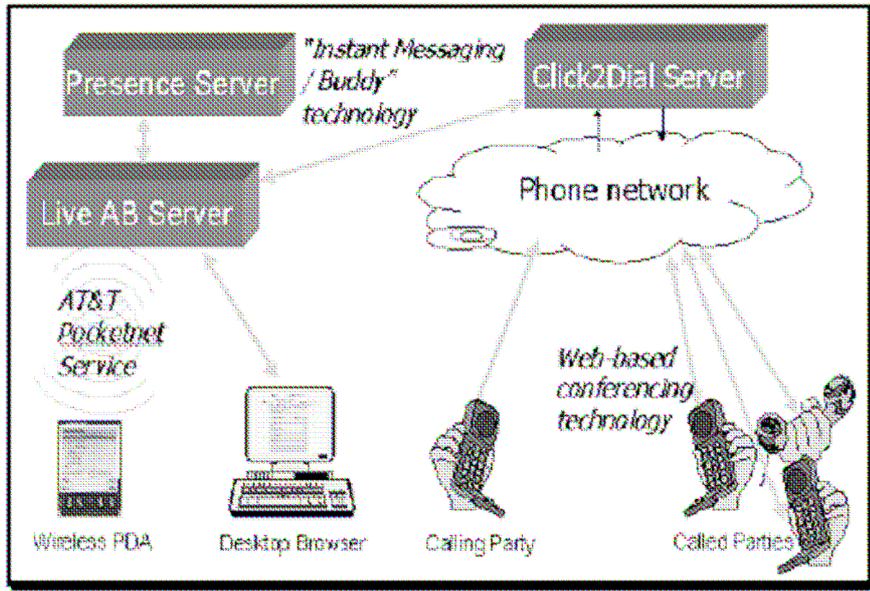


Figure A-2: Schematic Illustration of 'Live Addressbook' (Milewski and Smith, 2000)

Figure A-3 shows how the users manually can set their presence in form of availability, location, and a textual description in a web browser interface and how the availability of other users are displayed as icons in front of their names.

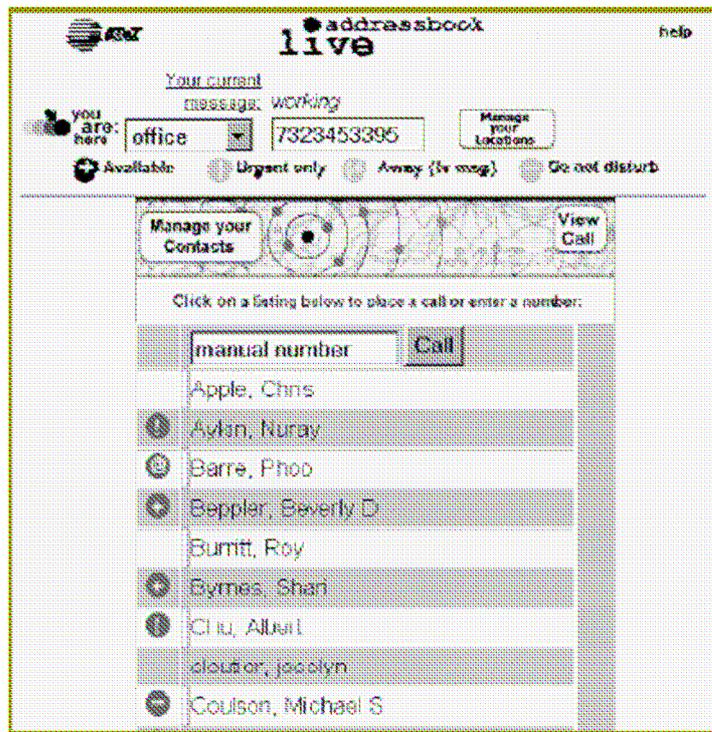


Figure A-3: Web Browser Interface of 'Live Addressbook' (Milewski and Smith, 2000)

A.3 Presence and Availability Service

Johnsrud (2004) describes a presence and availability service that can be used by other services. *Figure A-4* provides an overview of the service model.

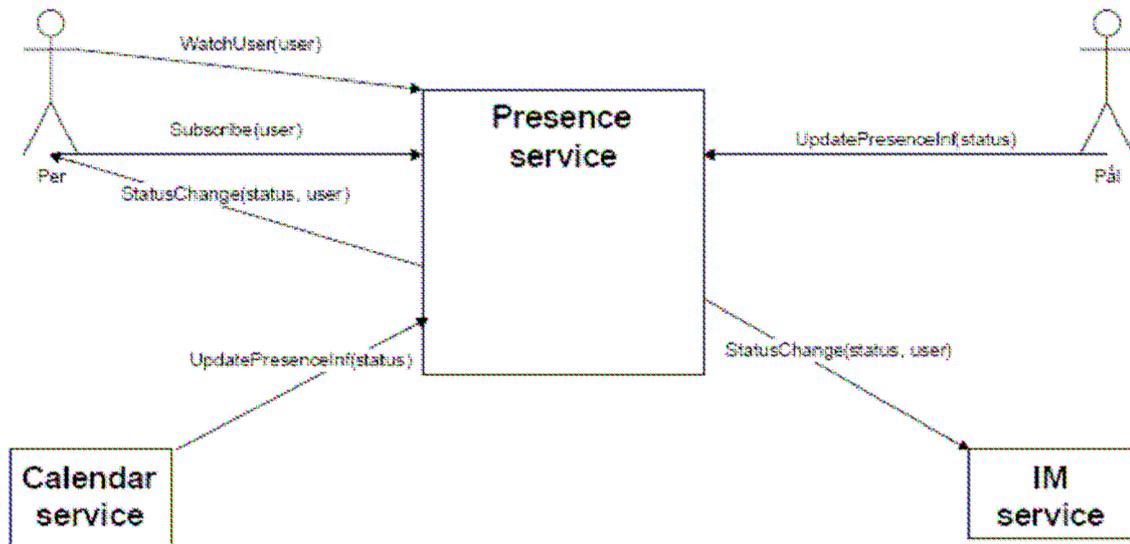


Figure A-4: Model of Presence Service (Johnsrud, 2004)

Presence information is aggregated in one place and can be connected to other services, such as instant messaging (IM) applications and calendar applications. The functionality consists of the following messages (Ibid., p. 23):

- **WatchUser(user)**
This message is sent from a user to the service which then asks the other user (given as parameter) of approval of access to presence information.
- **UpdatePresenceInf(status)**
The message is sent to the service in order to change status information about a user. This can be done either by the user itself, through a terminal client, or by other services.
- **Subscribe(user)**
When the service receives this message, the sender is notified of changes in the status of the user given as parameter.
- **StatusChange(status, user)**
This message is sent to a user or service that has a *subscribe* relationship to another user that has a change in status.

A.4 Group Communication among Hospital Workers

The project work of Forthun (2003) deals with solutions for group communication between hospital workers and the use of context-awareness and handheld devices. *Figure A-5* shows an example of how a nurse uses a handheld device in order to call for assistance when moving a patient. Another health care worker in the requested group replies to the real-time message by pushing a button on his or her handheld terminal. Different messages can be sent depending on the situation.

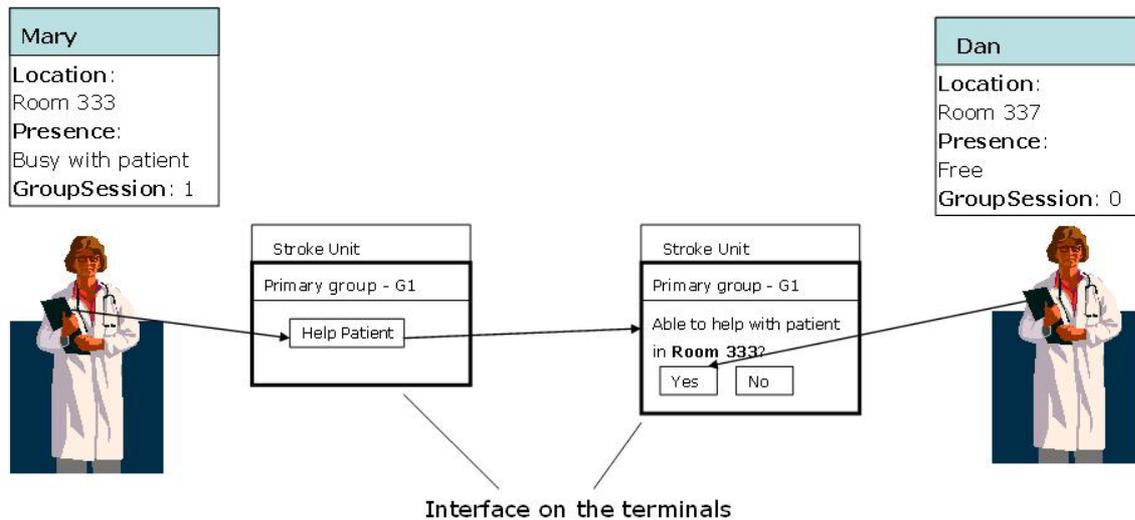


Figure A-5: Illustration of Group Communication in Medical Work (Forthun, 2003)

A.5 Use of Mobile Devices for Hospital Communication

Present work on a Master's thesis (Knudsen, 2007) by a student at the Department of Informatics at the University of Oslo looks into communication among clinicians at a hospital. In this work a prototype of a mobile communication device has been developed. Contextual information about the users' presence and availability is used in order to adjust and choose a proper way of communicating. The main menu and the navigation structure of this prototype are illustrated in *Figure A-6*.

This prototype offers different ways of synchronous and asynchronous communication, such as regular telephone calls, voice messages, and text messages. *Figure A-7* shows how the callee's activity information is presented to the caller. In this case the called physician is busy with a consultation, and the caller may choose the most proper mode of communication (and interruption). An addressbook is also implemented in the prototype, and people can be found and sorted by the hospital department they belong to and by profession or roles. By clicking on their names, they can be contacted on the chosen communication type. This is illustrated in *Figure A-8*, where the screen dump on the left shows a list of people in a specific department and the right screen dump shows how physicians at a specific ward can be sorted out and displayed.

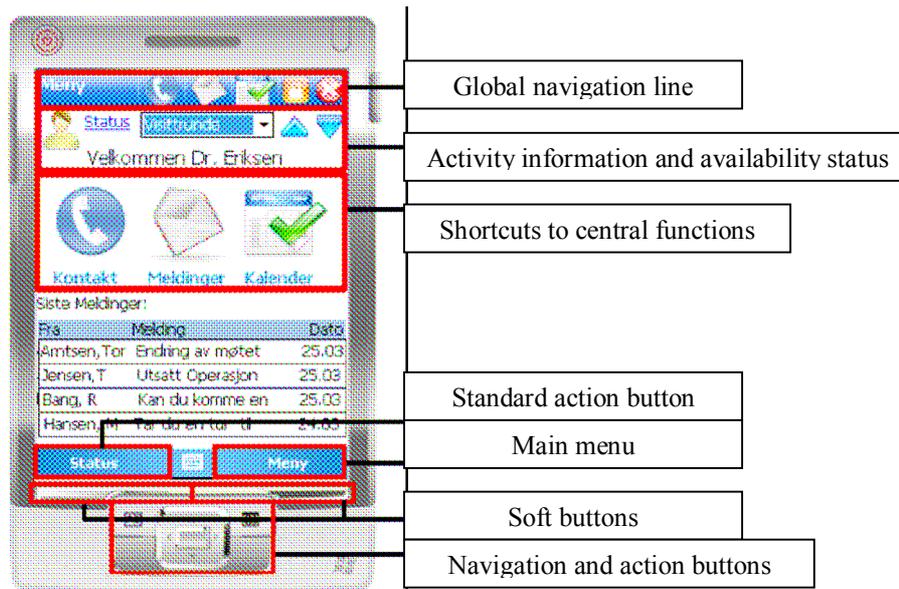


Figure A-6: Main Menu of Mobile Communication Device Prototype (Knudsen, 2007)



Figure A-7: Callee Activity Information and Communication Options (Knudsen, 2007)

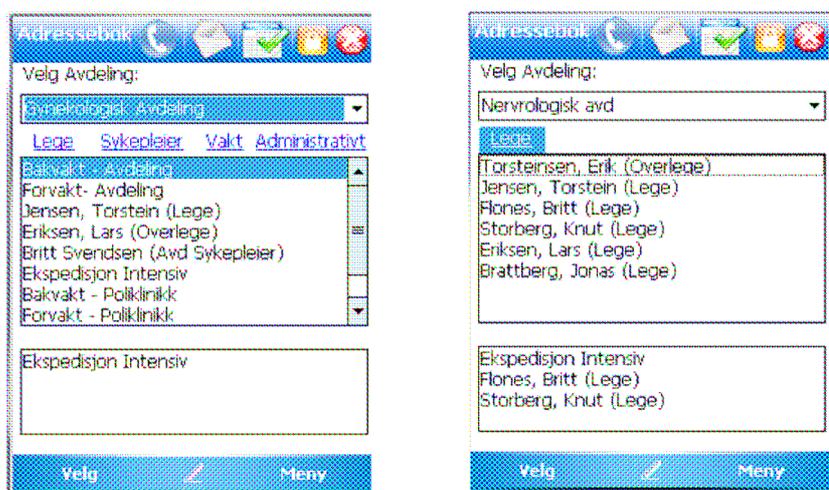


Figure A-8: Addressbook Sorting People by Department and Filtering by Roles (Knudsen, 2007)

APPENDIX B: Interview Guide

INTERVJUGUIDE

Alexander B. Årving

April 2007

Introduksjon

Dette dokumentet er ment som en veiledning til gjennomføringen av intervjuer i forbindelse med min masteroppgave i kommunikasjonsteknologi ved institutt for telematikk, NTNU, våren 2007. De som skal intervjues vil få en formening om hva samtalene vil dreie seg om.

Formålet med masteroppgaven er å undersøke hvordan ”menneske-til-menneske-kommunikasjon” og meldingsutveksling mellom sykepleiere, leger og andre ansatte ved Rikshospitalet brukes i de daglige arbeidsrutinene. Kommunikasjonsformene som er av spesiell interesse, inkluderer telefon, personsøker, e-post og andre meldingssystemer som brukes, men det er også interessant å studere andre former for kommunikasjon og samarbeid. Dataene fra studiene skal gi et grunnlag for å foreslå et passende nivå av integrasjon av ulike meldingssystemer og eventuelt forslag til nye systemer.

Gjennomføring

Ved hvert intervju vil kun den som intervjues og jeg være til stede. Det er satt av ca. 1 time til hver samtale. For at det skal bli lettere å arbeide med materialet senere, vil det bli benyttet utstyr for lydopptak under intervjuene.

Innhold i samtalene

Bakgrunnsinformasjon

Noen generelle spørsmål for å få litt bakgrunnsinformasjon. Det er ønskelig med variasjon i utvalget av intervjuobjekter.

Personalia:

- Alder
- Kjønn
- Utdannelse og bakgrunn
- Stilling og yrkeserfaring

Teknologibakgrunn:

- Ferdigheter
- Interesse

Dagens praksis for meldingsutveksling

Jeg ønsker å finne ut hvordan sykehuspersonell kommuniserer i hverdagen.

- Hvilke teknologier/kommunikasjonsformer er i bruk?
- Hvordan brukes de i forskjellige situasjoner?

Mulige fremtidige kommunikasjons- og meldingssystemer

Jeg ønsker å undersøke de ansattes holdninger/meninger om dagens kommunikasjonspraksis og eventuelt ønsker om forbedringer/endringer.

- Hvor godt fornøyd er de med dagens situasjon?
- Hvilke endringer kunne de ønske seg?
- Hvor effektive er dagens kommunikasjons- og meldingsrutiner i pasientbehandling?
- Hvor mye integrasjon mellom systemer vil kunne være ønskelig?

Avrunding

Den som intervjues har mulighet til å komme med andre synspunkter og meninger som ikke er blitt spurt om.

APPENDIX C: Interview Agreement Document

INTERVJUAVTALE

I forbindelse med min masteroppgave i kommunikasjonsteknologi ved institutt for telematikk, NTNU, våren 2007, ønsker jeg, Alexander B. Årving, å utføre kvalitative studier ved Rikshospitalet. Datainnsamlingen i disse studiene vil blant annet bestå av observasjon og intervju/samtaler med sykehusansatte.

Formålet med masteroppgaven er å undersøke hvordan ”menneske-til-menneske-kommunikasjon” og meldingsutveksling mellom sykepleiere, leger og andre ansatte ved Rikshospitalet brukes i de daglige arbeidsrutinene. Kommunikasjonsformene som er av spesiell interesse, inkluderer telefon, personsøker, e-post og andre meldingssystemer som brukes, men det er også interessant å studere andre former for kommunikasjon og samarbeid. Dataene fra studiene skal gi et grunnlag for å foreslå et passende nivå av integrasjon av ulike meldingssystemer og eventuelt forslag til nye systemer.

Intervjuene vil omfatte spørsmål som handler om hva de ansatte synes om dagens kommunikasjonssystemer og rutiner. De vil også ta for seg eventuelle ønsker om fremtidige meldingssystemer og mulige forbedringer fra dagens situasjon. Undersøkelsen omfatter ingen sensitiv informasjon eller pasientinformasjon.

Intervjuene vil bli lagret på digitale medier og utvalgte deler vil bli transkribert.

Materialet vil kunne brukes i fremtidige studier dersom ikke den som skal bli intervjuet eksplisitt motsetter seg dette. (Se Pkt 1 under.)

Tilgang til materialet gis uansett kun til dem som er involvert i den nåværende masteroppgaven (student og veileder) eller til forskere som vil stå i direkte tilknytning til fremtidige prosjekter der materialet vil være relevant.

Forskerne kan sitere eller parafasere deler av intervjuet. Dette vil skje anonymt. Navn vil i alle tilfeller bli erstattet med fiktive navn og data vil bli gitt på en form som *ikke* kan identifisere den enkelte som ble intervjuet. Dette vil bli kontrollert av veileder før oppgaveinnlevering. Navn vil ikke bli lagret sammen med lyd materialet.

Den som blir intervjuet kan be om å få kontrollere anonymiteten (se Pkt 2 under) og vil i så fall få lese gjennom teksten før den publiseres.

Før intervjuet utføres skal det foreligge to signerte kopier av denne avtalen. En beholdes av den som blir intervjuet, den andre beholdes av intervjuer.

Ved å signere bekrefter masterstudenten at han har forklart vilkårene for intervjuet slik de er beskrevet i denne avtalen.

Ved å signere bekrefter den som blir intervjuet at han/hun har lest det ovenstående og samtykker i intervjuene med følgende vilkår (kryss av for dem som gjelder, sett en strek over dem som ikke gjelder)

____ Pkt 1 – Videre bruk av materialet

Jeg ønsker IKKE at materialet skal kunne brukes i videre forskningsprosjekter. Transkripsjoner og notater ødelegges og lydmateriale slettes ved utgangen av desember 2007.

____ Pkt 2 – Kontroll av sitater og anonymitet

Jeg ber om å få lese gjennom alle sitater før publisering, slik at jeg selv kan kontrollere at anonymiseringen er fullstendig, og at mine uttalelser ikke er misforstått.

Dato for intervjuet: _____ Sted: _____

Navn til intervjuer (blokkbokstaver):

Signatur: _____

Navn til den som blir intervjuet (blokkbokstaver):

Signatur: _____

Kontaktinformasjon til den intervjuede (bare i tilfelle pkt 2 er avkrysset)

Navn:

Postadresse:

E-postadresse:

Telefon:

Kontaktinformasjon til intervjuer

Navn: Alexander Braadvig Årving

Postadresse: xxxx

E-postadresse: alexaa@stud.ntnu.no

Telefon: xxx xx xxx

Veileder for prosjektet er:

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