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Electronic communication across organizational borders in healthcare: an empirical study

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Abstract

This empirical study of the national message exchange system is aimed to serve as a partial evaluation within a local context, based on user experiences. The focus is justified by a neglected user-perspective in already existing evaluations and reports. A qualitative method based on semi-structured, open-ended interviews with clinical system users at the University Hospital of Northern-Norway and in the healthcare service of the Municipality of Tromsø, combined with informal meetings with project members and a literature review, serves as basis for the data collection.

ICT in healthcare is reckoned to improve communication and coordination in and between actors and service providers in the healthcare sector, and the exchange of clinical information with electronic messages is one of the main measures taken to achieve this. Healthcare work are of an complex and messy nature, and it is therefore impossible to predict what effects a new communication infrastructure will have on existing work practices and organizations as a whole. Establishing a new infrastructure for inter-organizational communication between such diverse and complex organizations will involve a lot of unforeseen consequences and challenges.

We found a great divide in how effective users found electronic messages to be. Hospital users described message use as additional work tasks, and as a rule had to rely on several methods of communication to ensure a safe and robust transfer of clinical information across health levels. The reasons for this appeared to be the need for more synchronous communication, a divide between administrative and clinical information handling in the municipalities, as well as low system compliance in smaller municipalities. Message structure was in many cases conceived as confusing, and there seemed to be a lack of a proper training strategy for system use. In communication between municipal healthcare and GPs, the system was experienced as time saving and convenient due to the way it supported the asynchronous work practices.

This goes to show that a rigid and standardized solution made to support collaboration across multiple, complex local settings in healthcare are not necessarily the best way to go. We argue that an on-going, thorough evaluation during the implementation process could have supported the work of mapping unintended consequences and dealing with them. A mapping of work practices could have identified the actual needs of the heterogeneous user group, thus cultivating the conditions needed to obtain a larger user-mass and supporting the systems initial growth. We have identified specific aspects that we believe could have contributed to this, such as closer follow-up and monitoring of smaller municipalities, a more thorough strategy for user education and message notification in the hospital's EPR. However, the gap between intended use and existing work practices seems too wide to be bridged by these measures. We argue that the EME system matches poorly with existing local practices in the hospital especially, and that local practises should have been taken into consideration before implementing a system on such a large scale. It is obvious that there has been a lack of user perspectives in the evaluation of the EME system up to this point, and our thesis must be seen as a contribution towards a more comprehensive system evaluation.

Acknowledgements

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Table of Contents

Table of figures

List of abbreviations

ANT	Actor-Network Theory
CSCW	Computer-Supported Cooperative Work
EME	Electronic Message Exchange
EPR	Electronic Patient Record
GP	General Practitioner
ICT	Information and Communication Technology
II	Information Infrastructure
IPLOS	Individbasert Pleie- og Omsorgsstatistikk
IS	Information System
IT	Information Technology
KS	The Norwegian Association of Local and Regional Authorities
MiK	Meldingsløft i Kommunene
NHN	Norwegian Health Network
NOK	Norwegian Kroner
NSF	Norwegian Nursing Association
NST	Norwegian Centre for Integrated Care and Telemedicine
NUC	Nursing and Care
RCT	Randomized Controlled Trial
RHA	Regional Health Authority
UNN	University Hospital of Northern-Norway

1 Introduction

Demographic changes in the Norwegian population, with a higher proportion of elderly and chronic patients, will require a more coordinated and integrated healthcare system. This has also been the motivation behind several White Papers and national projects. There have been major efforts to improve the delivery of healthcare services also on a regional level, amongst other with projects like FUNNKe and FIKS at the Northern Norway Regional Health Authority.

The healthcare system in Norway is characterized by fragmented services divided by organisational, economic and juridical borders. This has impeded the efforts to reach a more unified and coordinated healthcare delivery. Good and effectual patient flow between health levels, for example a hospital and the municipal care service, demands an efficient exchange of both organisational and clinical health information. Traditionally, this information exchange has been carried out by fax, telephone or paper.

In line with the changing demographic, the need for secure and effective information exchange will increase, and electronic message exchange is meant to replace a considerable amount of the communication that traditionally is carried out using telephone and paper-based solutions. Electronic communication and cooperation, as a broader concept than electronic messages alone, is perceived as both an instrument for supporting political ambitions, but also as a goal in it self. The development and evolution of electronic solutions for communication and cooperation has been an on-going process for decades, and progress has been made. From early systems supporting the electronic exchange of referrals and laboratory results, to e-Prescriptions and electronic messages. Technical standards, supplier requirements, work routines and systems have been developed through several national and local initiatives and projects in order to support and enable the transition to electronic communication and coordination.

In the northern RHA, the FUNNKe project has provided 85 out of 87 municipalities, several hospitals and multiple GP offices with the message exchange system, and thus

making them able to communicate with each other. This includes electronic dialog with GPs, exchange of documents in relation to patients' hospital admittance and discharge, coordination between services and discussion of clinical information with other healthcare providers.

A successful implementation of a new system is more than just the technical installation; the system also needs to support work routines and practices well enough to succeed and replace old procedures. This requires flexibility from both the system and its users, where both parties need to adapt mutually to each other. Electronic message exchange has largely been described as a consistent success, amongst other by the FUNNKe project leader and the Managing Director at University Hospital of North Norway in Tromsø in a newspaper article. Under the heading "Good health with good communication", they stated that users were unconditionally pleased with the system, and never wanted to *"...go back to telephone or fax"* (1). Although that may be true, it is a bold statement to make when the empirical support seems to be absent.

Some of the available documentation on electronic message exchange in this region seems to be based on weak methodological approaches and data of a more anecdotal nature. There is also a tendency that the prior research is empirically focused on a higher organisational level, where bureaucratic and economic gains seems to be both the motivation and the goal. It appears that well-founded research that focuses on end-user experience is absent. Without devaluing the more socio-economic focused research, we believe that the end-user perspective is too essential to be overlooked, and will through this thesis try to provide an empirical study that highlights this perspective.

1.1 Research questions

1.1.1 The aim of the study

This qualitative study addresses the end-user experiences and can be seen as a partial evaluation of the electronic message exchange system. Our mission has been to investigate how the primary users in two different health organizations experience it,

2

as this seems as a somewhat neglected point of view. However, it is not the goal of this thesis to label the electronic messaging system as a success or failure; yet, we want to contribute to the overall evaluation of the system with empirical knowledge. In relation to this, it is important to investigate terms such as "success" and "failure", and to understand implementation processes in healthcare. The empirical foundation is based on open-ended interviews with actual system users, as well as informal meetings with relevant project members and staff involved in the development, implementation and management of the system. The research setting is limited to Tromsø, with clinical informants recruited from the University Hospital of Northern-Norway, the Municipality of Tromsø, and a local GPs office.

1.1.2 Research questions

- How do existing organizational work practices influence the introduction and use of a new, asynchronous inter-organizational message exchange system?

- How do emerging unintended consequences created by the introduction of new standards for inter-organizational communication affect users' existing work practices?

- How has the regional system propagation strategy affected system appropriation and use?

- To what extent have the electronic message system replaced existing communication routines used for inter-organizational information exchange?

1.2 Outlining the thesis

Chapter 1 – Introduction

The motivation for this study is composed of personal experiences with clinical work and inter-organizational coordination, as well as a growing national and regional

initiative for improved collaboration. We outline the thesis and account for how the work has been distributed between the two authors.

Chapter 2 – Theory

The theoretical framework is derived from the syllabus and relevant literature. We draw on concepts and models from CSCW, II, ANT, and sociotechnical perspectives.

Chapter 3 – Method

The study is based on a qualitative interpretive approach, with empirical data collected from open-ended interviews with users, meetings, and project documents and reports. A reflection on the method is also included in this chapter.

Chapter 4 – Background

The chapter gives a systematic overview and review of the processes that led up to the development and implementation of the message exchange system. It also entails the work done by the regional project FUNNKe.

Chapter 5 – Findings

We present the main findings from our data, illustrated by relevant quotes. The focus of the chapter is on how users found the system productive, how it supported work tasks, and how new routines and unintended consequences emerged.

Chapter 6 – Discussion

Key points are discussed, like how the intended system routines coincided with existing work routines, how inter-organizational communication was affected, and the actual value of use for clinical users. Implementation, user training and organizational issues are discussed and seen in light of relevant theories and concepts.

Chapter 7 – Conclusion

In this part we focus on the findings and implications caused by the message system, and present what measures we believe could have been taken to face the challenges of implementing a new inter-organizational communication infrastructure.

1.3 Distribution and organization of the work

We have obtained approval from the study management and our supervisor to co-write this thesis. We both have an interest in the field of electronic cooperation and coordination between the health levels, and have written individual assignments on the subject prior to the thesis. According to the study regulations, we have to provide an overview over how the work was distributed between the authors. We have both been heavily involved with all parts of the study, and the work has been characterized by a consistent cooperation. With regards to the planning, outlining, interview process, transcribing and organization of data, this has been a process where it is difficult to divide and differentiate the responsibilities and workload. A detailed overview over who has been the main author for each chapter is located in Appendix 1.

Due to practical reasons, Kristian Berg has had the responsibility to contact and make appointments with municipal informants, while Kristian Nicolaisen has had the same responsibility towards hospital informants. All of the interviews and meetings were conducted with both authors present, but we alternated on assuming the main and supporting interviewer role. The reason for this is justified in the Method chapter. The transcribing of interviews was shared equally between us, as this was a mundane task that did not require joint efforts for each transcription. The process of organizing and coding data is further described in the Method chapter, but this was a shared effort that required a shared interpretation. This part was hence conducted fully by the both of us.

Although the process of co-writing this thesis has been challenging due to occasional different viewpoints and interpretations, we feel that it has enriched the study. We have had the ability to work with a broader scope than what would have been possible if we had worked alone. We also believe that co-writing this thesis has made it more reflected and sensitive to additional perspectives, and in such provided it with more depth. We truly hope this shows.

2 Theory

In this section we will define and explain different theories and concepts that we believe is relevant to shed light on our case and findings. We will start by presenting the user-oriented, sociotechnical approach for IS design, implementation and evaluation as suggested by Marc Berg. As the main goal of the electronic message exchange system is to support an increased level of inter-organizational communication and collaboration, we continue with drawing on aspects from computer supported cooperative work, or CSCW for short. To comprehend how the system is used and accepted by the users, it is also important to understand how, and if, it were designed to be meshed and integrated with the already installed base. In order to increase our understanding, we therefore present concepts from Information Infrastructure theory. Finally, to facilitate a more comprehensive understanding of the system and how various inscriptions have influenced the process of implementation and user appropriation, it has been important to draw on notions from Actor Network Theory.

2.1 A user-oriented sociotechnical approach to IS in healthcare

Literature in the field of information systems in healthcare seems to indicate that, despite a great number of technological sound initiatives supported by grand amounts of time and money, more than half fail to meet their expectations (2-7). Traditionally, the most frequently addressed theme when evaluating such systems has been the technical issues related to design and evaluation, and unfortunately, the fact that these systems are to be implemented into extremely complex organizational settings seems to be somewhat overlooked (6, 8, 9). To understand and cope with the multifaceted nature of these issues, and to bring the more complex practices and challenges into view, Marc Berg proposes a sociotechnical approach towards IS in healthcare (3).

In the 1970s, companies started to introduce management systems that often ended up changing the organization of work, as well as creating new or different individual work tasks. As the main purpose of these systems was increased managerial control, they where often met with some reluctance and opposition from the general workforce (8). As researchers, managers and system analytics realized that system

development did not only involve problems of a technical nature, but also encompassed social and organizational problems, a new understanding of system development sprouted into being. The term "sociotechnical system", alongside similar notions as "human-factors" and "social-systems" was grounded, and rapidly gained momentum. In the beginning, sociotechnical system theory focused primarily on ensuring job satisfaction to increase organizations efficiency. It was believed that this in turn would lead to more loyalty towards the company and ensuring higher production levels and performance. Bansler describes the sociotechnical theory by explaining:

> … *Sociotechnical systems theory treats organizations as two systems – a social and a technical system – which function together. In order to function optimally, the two subsystems of the organization must adapt to each other and be in a state of harmony or balance* (8, p. 11).

Marc Berg argues that the socio technical approach in recent years has shifted, and explains that by "*embracing a user-oriented perspective, a sociotechnical approach emphasises that an in-depth insight into the settings where the systems are to be used should be the starting point for the design and implementation of these systems*" (3, p. 89).

As the potential of such systems only can be achieved through the actual interaction between the system and the user, it seems only natural for this to be point of focus. Hartswood et al. states that technologies will only deliver their potential benefits if their design, development and deployment facilitate sufficient opportunities for user-led evolution (10). However, as Ellingsen and Monteiro point out, the conditions for such an approach to system design and implementation are often undermined by politically motivated, regional changes towards standardization (11). They continue to argue that tension can be created when a system which is made to fit with specific local practises are to support integration across several local practises. The design of standards for one local setting can thus affect the introduction of the system in another, and imposing "order" in one local setting, can produce disorder in another setting, for other users (11).

The evolution of the sociotechnical approach has intertwined the social and technical aspect even tighter, and Berg describes healthcare practices as heterogeneous networks:

> *...(in these networks)...one should not attempt to pry it apart in a 'social' and a 'technical' system. 'Technology' and 'organization' do not occupy separate domains or operate according to separate logics; nor does their relationship develop in some unilinear way (the former 'causing change' in the latter or vice versa)* (3, p. 90).

In addition to the people involved, these heterogeneous networks consist of constitutive elements and tools like organizational routines, documents, information systems and so on. Changing, removing, expanding or including new tools can entail consequences that might reverberate throughout the whole of the organization (3). This view is supported by Bannon and Schmidt who states that "*by changing the allocation of functions between humans and their implements, changes in the technology induce changes in the organization*" (12, p. 15). So, even though the consequences of new IS in healthcare might be grand, there is no way of predicting exactly what will happen. Consequences are highly dependent on the context they are implemented in, and evolve differently in every practice the IS are introduced into. According to Bannon and Schmidt, computer systems must be seen as an organizational change agent above all other, because of their high grade of flexibility (12).

Workers roles and the relationship between them are shaped within these heterogeneous networks. It is thus difficult to describe or give the entities in these networks pre-set specifications, as their characteristics, roles and functions are negotiated and acquired only as a part of that specific network (3). Nor is it possible to distinguish a specific set of solely technical or social problems that may occur when designing or implementing new systems due to their complex and unpredictable nature. Some possible unintended consequences mapped out by Ash et al. is additional work tasks for the users (often of a clerical nature) and disruption of already existing smooth workflows and communication routines (13). Systems initial purpose of reducing errors and streamlining work could thus be severely hampered by such unintended consequences, and it may ultimately lead to the exact opposite.

Another important aspect for the sociotechnical approach towards IS in healthcare is the complex coordination and collaboration that characterize work. Though the primary goal is to manage the patient's disease, care and pathway through the healthcare system, work is rarely or never accomplished by the means of single individuals. All work has some form of collaboration tied to it, and often it stretches across numerous professions and organizations. The complexity of the organizations, and patients individual and unpredictable reactions to treatments, makes it an environment of constantly emerging sudden events that has to be dealt with on the spot with whatever resources available (3). These sudden events have to be handled by different people, with diverse backgrounds and from different professions, which in turn naturally shape what and how decisions are made. All these factors contribute to the complexity of the networks, and also introduce the need for articulation work, which will be presented more thoroughly in the next section of this chapter.

Through the sociotechnical eyes then, work is seen as a cooperative work process rather than tasks performed by individuals in different organizations. Further, it emphasizes that it is not possible to fully predict healthcare work, or make pre-fixed workflows or pathways. They can be useful, yes, but it must not be overlooked that a preset workflow never can describe all possible actions taken within. There are always minor processes and actions that are not possible to standardize, or implement in a workflow. Berg state that this is an important issue to stress as:

> …*rationalist, technology-centered discourses are still all-pervasive within our field. Such discourses emphasize the messiness of current work practices, the need to weed out variability in practice, and the opportunities of PCISs, protocols and other such tools to finally bring 'structure' and 'rationality' to the work of doctors and nurses*. (3, p. 92)

Caution must be exercised when introducing too much structure and formality into systems meant to support work practices within healthcare, and should be paid close attention to in future system development. This is not to say that more structured or formalized systems are free of potential, or that today's current situations are flawless, but it is essential for the future of IS in healthcare to somewhat lower the expectations towards anticipated outcomes and results, as well as utilizing a more empirical informed view of doctors' and nurses' work in the field (3).

2.2 Implementation and Evaluation of IS in healthcare

One option when evaluating health information systems is to directly measure outcomes as percentages of use or economic savings. In our case for example, one option could be counting the number of messages sent, or measure how it reduce time spent on other means of communication. However, the danger by exclusively relying on numerical data is that important aspects, such as message content or how the system affects work practices, can be neglected. Terms such as "success" and "failure" are multifaceted and with many dimensions, and cannot be measured by solely looking at certain aspects of the system (2). Unfortunately, in many cases it is the "prevailing voice" that often determine how the system is labeled, and the voice of primary users have a tendency to be overlooked. Undesirable consequences often seems to be blamed on the system itself, despite that fact that many of the harmful or undesirable outcomes seems to evolve from the interplay between the IS and the existing social or technical conditions of the organization (14). According to Sittig and Singh, there is a lack of analytic models for evaluation of IS in healthcare that encompasses the multilayered nature of IS and the organizations they are to function within (9).

To label a new system as a success or a failure is not a task done easily. As presented in the section above, IS are introduced into highly flexible and complex organizations, and the systems themselves are often very multifaceted by nature. One of the primary challenges of designing, developing, implementing and evaluating new IS is to operationalize their use within these complex work practices, known for its hectic and high pressured nature (9). In addition, there is an abundance of stakeholders in the process of obtaining and implementing a new system. There are directors, managers, vendors, developers, section-managers and users, to mention some. All of these stakeholders may have their individual view of what would characterize the system a success or failure, and could even find the system to perform satisfactorily on one level, but unsatisfactorily on another (15). An organizations' view of the system as a success or failure should rather be socially negotiated, and not dominated by the views of only one, or few stakeholders (2). To achieve an in-depth understanding of the IS and the impact is has on the organization, an evaluation should hence include considerations from several dimensions (9).

When implementing IS in healthcare, the nature of the systems and the workplaces themselves makes it impossible to predict a predefined set of success factors, and the implementation of a new system should be viewed as an organizational change process and development rather than a purely technical project (2). Ash et al. state that the integration of technologies into healthcare practices creates a large sociotechnical system, which can lead to the emergence of different behaviors, but due to the sheer size of these systems, the overall behavior can never be fully predictable (13). To reduce the number of unintended consequences following introduction of new IS, and prepare users and other stakeholders to deal with challenges that may arise, implementation of a new system should include representatives from all layers of the organization, and users should especially be paid close attention to from the start. Berg states that an attempt to structure and plan the process of implementation too rigidly should be avoided due to the complexity and unpredictability of the IS and the number of stakeholders (2). He further argues that it is important to exploit unexpected and alternative uses of the IS as an opportunity for learning and adaptation. He promotes that it is essential to create synergy between primary and secondary work processes and the IS by:

> *...creating the circumstances so that IS functionalities can bring primary and secondary work tasks to new levels of quality, efficiency, and/or work satisfaction-whether that means an enlarged span of control for administrative personnel, an improved grip on the patient's trajectory for the health care professional, or a novel sense of autonomy for the patient. (2, p. 153)*

The aim should be to transform primary work processes, alongside with other secondary work processes, like billing and managerial tasks, while at the same time aligning these processes. The most important task in order to achieve synergy is to construct a work environment with an inherent willingness to learn and develop the IS and the work processes, which in turn requires an ongoing evaluation of the system implementation process. In contrast, if the implementation process is merely seen as a "rollout" of a new system, many of the encountered challenges can easily be classified as user resistance, or "suboptimal returns of the IS" (2). When it comes to implementation strategy, Ciborra et al. emphasize that it should not be considered as a document which is to be handed over to the executing organization, but that it rather emerges from the actual implementation process and can be affected by deviations, surprises and conflicts (16).

To achieve a proper implementation and evaluation of IS in healthcare, Sittig and Singh have proposed an eight dimensional model that encompasses aspects that they believe should be taken into account (9). Some of the concepts from this model are highly relevant for our case. First of all, they underscore that the different dimensions of the evaluation cannot be seen as separate, it is thus not possible to study only one or two of the dimensions singularly. All dimensions of a new system must be studied in relation to each other. Secondly, in addition to the traditional sociotechnical aspects related to system evaluation, this model also encompasses the internal organizational policies, procedures and culture as well as the external rules, regulations and pressures which also comes into play (9). Evaluations must be regarded as a continuous process and run over time to catch the true nature of how the system and the organization intertwine and affect each other. Following this notion, it must also be taken into consideration that the target of evaluation is constantly moving; the organization can change, as well as the system it self (15). Due to our limitations in time and resources, our case and thesis must therefore be seen as a step along the way towards a more comprehensive evaluation of the electronic message exchange system.

2.3 Supporting cooperative work within healthcare

2.3.1 Computer supported cooperative work

The main purpose of the Collaboration reform and the rollout of the EME system on a nationwide scale were to ensure an increased level of collaboration and communication between the health levels in Norway (17). This, combined with the complex and collaborative nature of healthcare work discussed above, makes it natural to draw on concepts from the field of CSCW when attempting to understand and map out some of the intricate sociotechnical challenges related to the introduction of the system.

The definition of the concept CSCW and the term cooperative work has been somewhat disputed. We do not intend to discuss all proposed definitions here, but will present what we find most suitable for our case and research. According to Grudin and Poltrack, the field of CSCW is at the intersection between collaborative behaviour and technology. More concrete, it addresses how different systems and IT-solutions

facilitate, impair or change collaborative activities, and could in theory deal with all instances where computers have a role in cooperative work (18). Bannon and Schmidt regard cooperative work as work processes that are related as to content, or in other words processes connected to the production of a particular product or service (12), while Schmidt and Bannon argue that people engage in cooperative work when there exists a relationship of mutual dependence, and cooperative work is needed for accomplishing the work (19). Schmidt and Simonee further state that an important issue in CSCW is to understand how communication systems can reduce the complexity of "*coordinating cooperative activities – individually conducted, yet interdependent*" (20, p. 1). When applying these definitions to healthcare, the concept of appropriate treatment and care of the patient must be regarded as the provided service. Cooperative work is thus characterized by being somewhat premeditated, this is not to say that the work process is mapped out and planned in its entirety, but that the overall goals and expected outcomes are to a certain degree clear. In healthcare for example, all personnel are in essence working towards ensuring proper treatment and care for the patient. This also means that there is a lack of organizational boundaries, and that cooperative work is rather defined by the actual cooperative behaviour, which especially in healthcare often stretch beyond a single organization (19).

CSCW have been associated with the term "group work", but as Bannon and Schmidt point out, this term is too narrow to include all aspects of CSCW (12). They suggest that cooperative work can be indirect or direct, and of a distributed or collective nature. Group work, or work done *collectively*, must thus be seen as one type of cooperative work. When several semi-autonomous workers change their behaviours as the context changes and plan their own strategies, the work is of a *distributed* nature. When cooperative work is conducted *indirectly* it is mediated by a changing state of the transformation process, in contrast to *direct* when it is mediated by interpersonal communication (12). Schmidt and Simonee propose that all cooperative work is in essence of a distributed nature. Not only is it spread out over time and space, but actors are also semi-autonomous in terms of the different circumstances they are faced with in their work, like strategies, perspectives, goals and motives (20). Grade of distribution is dependent on the complexity of the interdependence between the workers, i.e. how distributed the work tasks are in time and space, the number of participants, and the structural complexity of the field of work. This is truly the case

for healthcare, as important features of healthcare work are that it often takes place over several organizations and has an inherent collaborative and complex nature. Cooperative work is thus a technical necessity to ensure a well functioning healthcare system, and proper treatment and care for the patient.

2.3.2 Articulation work in healthcare

An important aspect of CSCW is to map out the articulation work that take place in organizations, and to make sure that this work is taken into consideration when designing new systems. Articulation work is not the practical work needed to treat a patient, like administrating medication or performing surgery, but the work that allows for this work to take place. Schmidt and Bannon state that; "…*articulation work is seen as a set of activities to manage the distributed nature of cooperative work*" (19, p. 18). In healthcare, this work is most often performed by nurses and assistants (3), and the term "coordination" can be used to catch many of its features (21).

The more distributed cooperative work is, the more articulation work is needed to coordinate, schedule, align, mesh and integrate the work tasks. To help reduce the cost of doing this work, coordination mechanisms like protocols, formal structures, standards, plans and procedures can be introduced (19). Coordination is essential to CSCW, and it is often defined as the process of bringing artifacts and activities together and making them a part of a larger system (22). One strand of research in CSCW deals with how coordination mechanisms take form and can change coordination practices. Such mechanisms can be separate and distinct, but be seamlessly interwoven in practice. Procedures developed for special contexts make sense because of their shared meanings; they are shaped by its social components, and can in turn shape they way decisions are made (22).

Another strand of research focuses on how the spatial and temporal scope can shape the articulation of collaborative activities. This entails the activities performed in order to ensure that distributed actions takes place at a time which makes the realization of a collaborative activity possible, both in relation to one's own actions, and the actions of other actors. The overall characteristics, or goals of the

coordination mechanisms, are to help reduce the complexity of articulation work by rationalizing it through segregation, standardization or coordination. Such mechanisms are helpful, but due to the nature of healthcare work discussed above, it is not possible to fully predict or plan the work, and task allocation and articulation must in these organizations be negotiated and renegotiated continuously (12). This means that healthcare work requires continuous articulation work to deal with sudden and unexpected events. Articulation work can be difficult for outsiders to see, and it has often been unnoticed in the design and implementation of new systems into organizations. In their paper from 1989, Bannon and Schmidt underscore that the consideration of this "hidden" work is essential to create functional systems that will be accepted by the users (12). One consequence of ignoring the intricate articulation work that takes place in complex healthcare organizations could be the creation of additional work routines, which ultimately lead to redundancy when coordinating work between the users.

2.3.3 The role of redundancy

By tradition, redundancy in relation to IS and organization of work routines have been regarded as an unwanted problem that needs fixing (23, 24). Studies show, however, that only a modest level of problems actually arises as a result of redundancy, and that it under certain conditions can be productive (23). In regard to inter-organizational cooperation it becomes highly relevant to consider the role of redundancy, especially when the context is the implementation of new IS, in this case the EME system.

Incompatibilities between different IS, and the inability to effectively share information across both technical and organizational borders, are claimed to represent one of the major impediments for progress towards shared, and arguably integrated, care (23). Measures to improve the situation have often been extensive standardisation of both work routines and technical system functionalities. Such efforts of purification does, however, neglect to account for the complexity that clinical work represents (23).

Before measures designed to eradicate redundancy and apply encompassing standardisation are integrated, one needs to analyse how practitioners actually work

with, and use, redundancy. Only by accounting for the actual work and practices, can one successfully develop strategies for design and implementation of new IS (23).

By using different artefacts and technologies, users of IS are highly competent of bridging the gaps between systems and handling redundancy in order to solve their tasks (24). This is not to say that all redundancy most be tolerated, but an argument for assessing all the pros and cons before passing judgement on the matter (23). One of the beneficial effects of redundancy is that it may provide robustness to work; if one component fails, the whole system does not grind to a halt. In such, redundancy may increase the ability to circumvent errors and generate alternative actions, and thus be a source of reliability (24). Technologies and artefacts not technically integrated with the system may be regarded as socially integrated as users link various tasks to different artefacts on the basis of knowledge and experience. It would therefore be inexpedient to remove redundancy on the basis of principle. This emphasises the importance of accounting for the complexity of clinical work.

In this context it is relevant to consider the related subject of *supplementary information*. It differs from strictly redundant work in the fact that it supplies some new information. Supplementary information supports the collaborative needs and interest to local and situated contexts of use (23). In regards to the EME system this is highly relevant, as the cooperative nature of the system needs to be supported by local customization and specific contexts of use. Supplementary information is argued to facilitate robustness to collaborative work by establishing and supporting a shared and flexible understanding (23).

2.3.4 Supporting informality and transparency with IS

Computer systems frequently evolve around the support of information flows, a strategy which Schmidt and Simonee says to be highly idealized, and inadequate for analysing and modelling the articulation work of real-world settings (20). The articulation work needed to create the "flow" in workflows are in other words often neglected and not accounted for. Informal interactions between participants in cooperative work are in most cases essential for these information flows. In addition to have important sociological functions as human support networks and mediators of

companionship within organizations, they are often crucial for the actual conduct of the work processes themselves (12, 20). It seems central to consider both the formal and informal language of cooperation when designing systems to support cooperative work. According to Bannon and Schmidt, neglecting one of these levels makes systems in peril danger to fail (12). They continue to argue that the formal level is meaningless without an interpretation, and that the cultural level is vacuous without being grounded.

Another important aspect in order to support inter-organizational cooperative behaviour is how technological applications should promote a shared workspace. Due to the fact that cooperative work can be of both an indirect and distributed nature, it is important for participants to have access to information created by different participants, who might also be situated in other organizations (12). Cooperative decision-making must hence involve a continuous process of ensuring and validating information produced by other participants. This implies that some mutual critique has to be applied to decisions arrived at by another person you are to cooperate with. To achieve this, the shared information space must be transparent (12), and make it possible for the other participant to go back and track what led to the decision. The background and context of the decision should be clear in order to ensure trust among the participants.

The aspect of neglected articulation work still appears to be relevant today due to the high number of failed IS initiatives in healthcare. In a review of 25 years of CSCW research in healthcare, Fitzpatrick and Ellingsen point out that in despite of much time and money going into large-scale ICT projects, with high expectancies of efficiency and improved quality, it has been a challenging task to get things right (25). Greenhalg state that new IS in healthcare more easily can promote the streamlining of secondary outcomes, but that there are greater challenges for it to make primary clinical work efficient (26). As mentioned above, they also argue that the reasons for the encountered troubles are complex, because it entails highly institutionalized and complex organizations, with complex work practices, multiple stakeholders, several health levels and private and public funding arrangements, to mention some.

On a broader scale, CSCW-research aims toward a rich insight in healthcare practices, with many papers also proposing principles on how to design collaborative systems. It acknowledges that the implementation of new IS in healthcare is an incredibly complex, diverse and locally situated process, and also present the way new technologies can result in unintended organizational consequences. It encompasses both the technological and social aspects of introducing new technologies and communication systems into healthcare. There has been a tradition of measuring the outcomes of new IS systems in objective measures such as cost savings (27), while in our case and in a considerable amount of CSCW research, the goal is to set the focus point within the organization rather from the outside, and emphasize the voice of the users.

2.4 Information Infrastructures

2.4.1 Supporting information exchange by evolving the infrastructure

When investigating new systems in healthcare, especially one like the EME system, supposed to create a new communication infrastructure, it is difficult to avoid drawing on concepts from Information Infrastructure theory. II's are described as all of the people, processes, procedures, tools, facilities, and technology which supports the creation, use, transport, storage, and destruction of information (28). It is difficult to apply specific goals or purposes to an II, other than the general idea of supporting information related services to a certain organizations, set of organizations or communities (29). Aspects presented in this section must therefore be seen as an overarching theoretical framework for our thesis.

Hanseth and Monteiro state that II's can be seen as the combination of information and infrastructure technologies (30). Due to the rapid development in the field of computerized information systems, many different IT systems have emerged, which in turn creates heterogeneous networks of systems that are reliant on each other to function satisfactorily. These networks are common in large organizations, and especially in healthcare. Combined, the systems, artefacts and the people in an organization become part of a complex, evolving and heterogeneous sociotechnical network, which Hanseth and Monteiro call an Information Infrastructure. They further define an II as: *"... a shared, evolving, heterogeneous installed base of IT capabilities*

among a set of user communities based on open and/or standardized interfaces." (30, p. 208).

Hanseth and Lyytinen have proposed some key aspects to grasp the concept of IIs. First of all, infrastructures have a *supporting*, or *enabling* function (29). This entails that an infrastructure should support an abundance of different activities; it is not tailored to support only one specific task. It is enabling as it can open up a field of new activities, and not only made to automate or improve something that already exists (29). The second aspect is that an infrastructure is shared by a large community. This refers to the notion that the same object is in use by many actors. The third aspect is that infrastructures are *open*. There are no limits for what can be included in the infrastructure; e.g. number of users, stakeholders, vendors, technological components, application areas or network operators (30). A hospital is a good example to illustrate how an infrastructure can be viewed as open; a hospital shares its information with many other medical institutions and public offices, these institutions might share the info with other institutions again. Following this chain of thought, a hospital can be said to share their information with virtually any institution in the world (29, 30).

Another important aspect is that IIs consists of more than the physical facilities used to store, transmit, process, and display voice, data or images. It consists of all elements that have a role to play in this process as well. This describes aspect four, which states that an II is more than pure technology; they are rather *sociotechnical networks*. Thus, it becomes clear that IIs are heterogeneous, as they consists of many different elements, both human and non-human (30). These elements are necessary to sustain and operate the infrastructure, and are connected in complex ways and change constantly. The fifth aspect is that IIs are connected, and interrelated, constituting *ecologies of networks*. This refers to the fact that infrastructures are built in layers and consist of many sub-infrastructures which is interwoven and connected to each other (29, 30).

As new needs appear, the infrastructure has to adapt and evolve to meet the demands. New modules have to be integrated and be able to communicate with the already existing infrastructure; the new and the old have to be interoperable. This means that

the new modules are heavily dependent on the already existing II (30). The sixth aspect is hence that infrastructures develop through extending and improving *the installed base*. This entails that the installed base and its organization influences design of new components.

Regarding the design of II's, Hanseth and Lyytinen argues that there are few design theories addressing how existing artifacts and communities affect and mesh with the design of new IS, or in other words, new parts of an II (29). They point out that in contrast to traditional IS-design, II's continues to evolve beyond designers proposed timeframe. It thus makes it insufficient to look at applications as specific means to support dedicated organizational tasks, only based on context-specific user requirements. When one introduces changes to an II, one should treat the already installed base as an actor witch sets its own requirements for design. To answer this need, they have proposed a theory that tries to include specific infrastructural features as an instrument for design.

2.4.2 How IIs grow and change

In traditional IS-design, one normally finds design goals as user friendliness, effectiveness, user satisfaction and system acceptance. When constructing, changing or expanding an II, such goals must rather be looked at as means to persuade users into participating in the infrastructure. The inherent goal that applies to II's as a whole is to grow, and strategies should aim towards influencing this growth. To increase collaboration between health levels, like with the EME system, it would be beneficial for the existing II to grow and expand by recruiting more users in communicating organizations. Before trying to influence the growth of II's you should, as mentioned, start by considering what "we already have", i.e. the installed base.

To make an infrastructure grow, it should obtain a momentum by making the installed base a new independent force, which in turn will affect further growth. When it gains enough momentum, it will inevitably become independent. In other words, when implementing a new application, system, or communication infrastructure, the goal should be to stimulate for as many users as possible to participate. By doing this, the changes to the organization, work practices and systems (i.e. the installed base) will

become more permanent, as the change becomes irreversible. For example, users who experience immense and immediate benefits of a new system, in contrary to what already existed, will most likely protest and not wish for it to return to its original state. Hanseth and Lyytinen argues that infrastructures also should be flexible in order to allow for change, as first versions often are of poor quality. It should be able to change as users appropriate the system, and experience what is needed both technologically and in terms of users' skills to use the system effectively (29). In other words they should be flexible on the technical level, as well as allowing users to appropriate and use it in different ways.

A common problem is that new infrastructure designs never "take off", as they fail to establish a large enough user base in order to become self-reinforcing. If no users find a new infrastructure useful, its installed base will neither grow. Designers of new infrastructures should therefore strive towards cultivating this growth. If growth is successful, there is a danger of lock in's, where users become to dependent on the technology, and the cost of shifting to a new one is to high. Technological lock-in's appears when standards in the technology become inadequate for new technologies. The dilemma is thus to support the initial growth and gaining momentum, while at the same enabling openness and evolution (29).

Johannessen, Gammon and Ellingsen use the phrase "infrastructuring" to describe this work of changing, or expanding the infrastructure (31). One of the issues when expanding the II is that new parts may struggle to gain foothold, as it can inherit the strengths and limitations of the already installed base (32). As presented in the section above, this implies that the new features should fit with the already existing information systems as well as with the existing practices and users, as these factors also can affect the way new features evolves and function. There are both technical and sociological factors that determine the possibility for expansion or change of the infrastructure. Zittrain suggests that one must assess these factors together when assessing the opportunity of flexibility, and implies that the ability to change something in a system is dependent on not only the technical design, but also on social behaviours of the people using the system (33). Johannessen, Gammon and Ellingsen further state that a certain degree of this dual flexibility could promote and

support local practices for an II (31). This falls into the wider sociotechnical way of understanding the impacts new IS in healthcare might impose.

2.4.3 Design principles in order to cultivate II growth

In the case of the EME system, we will mainly focus on how to initial growth and momentum was supported in order to create a self-sustaining system. Hanseth and Lyytinen have developed a set of key design principles they propose can be of assistance when changing IIs. When changing an II you are in essence building a new version of the already existing II, as the changes will build upon the already existing base. To allow for this new version to function properly, it has to obtain a large enough user mass to make it gain momentum (29). The electronic message exchange system can in essence be seen as a change, and expansion, of the already existing installed base.

The first principle is to *design initially for usefulness*. The first version of the infrastructure must offer immediate benefits for its users. It should involve tailoring the first infrastructure to serve the needs of the first users. The first version should also be cheap (simple software, cheap hardware) and easy to learn. This will help to make the investment justifiable for first users. They also become easier to implement in user organizations as it lower learning costs and provides simpler integration with the existing infrastructure. Each II will finally support many information services; these vary from services where everybody communicates with everybody, to services where one user provides information to all others. Services supporting the information access or distribution from one point to a large group should be implemented first (29).

The second principle is *to build upon the existing installed base.* This principle suggests first selecting supporting infrastructures that portions of the group of users is familiar with. If application infrastructures requires a new infrastructure to function, it will make implementation more difficult, and create barriers to establish the new infrastructure (29). Principle three is to *expand the installed base fast by persuasive tactics to gain momentum.* This suggests that the designer of a new version of an infrastructure should try and find as many users as possible to adopt the version, in

order to gain momentum. One should try to create the possibility for positive feedback, which refers to the notion that an infrastructure will gain value primarily through the size of its user base. Hanseth and Lyytinen state that new functionality should only be added or integrated when it is needed, when it have a large enough user mass that its use value can justify the users to the costs of introducing additional functions, or when the users them self "discover" new solutions in the process of learning-by-doing.

To allow for an II to be used or changed in such new or unexpected ways, Oudshoorn and Pinch states that it is necessary for the users to appropriate or take possession over the technology (34). This does not only imply that users make use of the technology and interact with it, but that they take ownership of the technology on a social, cultural and economic level (34). Furthermore, they state that once the technology is appropriated, users have the possibility to reshape the technologies' features, and use it in new and unexpected ways. Appropriation of new technology should therefore be a part of its initial design and implementation, and users must be "allowed" to appropriate the system.

The last two principles suggested by Hanseth and Lyytinen deals with ways to avoid technology lock-in, something we have chosen to attach less importance to, as it in our case would demand a more thorough analysis of the applied technology and its features. Briefly, the characteristics of the two last principles addresses that II has to be designed with flexibility in mind in order to allow for change. Designers should try to focus on simplicity in the architecture and standards of the II, as it is inevitable that it will have to change over time. It is obvious that it is easier to change something small and simple in opposition to change something large and complex. They also recommend a strong focus on building the infrastructure with modules, or sub-infrastructures, and to use gateways to connect different regions of the infrastructure (29).

2.5 Actor Network Theory

2.5.1 The power of inscriptions

As the implementation of the electronic message exchange system was grounded on a national level, and thus involved an multitude of different actors, it becomes natural to draw on aspects from Actor Network Theory to achieve a wider and more comprehensive understanding of how different interests are aligned, and how inscriptions has affected how users experience the system today.

Hanseth and Monteiro state that the idea of Actor Network Theory (ANT) is fairly simple, and tries to show it by an example:

> *When going about doing your business - for example driving your car - there are a lot of things that influence how you do it. For instance, when driving a car, you are influenced by traffic regulations, prior driving experience and the car's maneuvering abilities. All of these factors are related or connected to how you act. You do not go about doing your business in a total vacuum but rather under the influence of a wide range of surrounding factors. The act you are carrying out and all of these influencing factors should be considered together. This is exactly what the term actor network accomplishes. An actor network, then, is the act linked together with all of its influencing factors (which again are linked), producing a network.* (30, pp. 96-97)

Following this, we can understand ANT as a language to describe the small technical and non-technical mechanisms we find in IIs. The development of ANT started out in the sociology of science and technology, as there often was talk about the impact technology had on society and vice-versa, but problems related to the integration of the two as a whole (35). Latour states that the separation of the social and technical was inconvenient because every time a stable social relation is discovered, a key factor for this relative durability was a non-human element (36). This is very much in accordance with the sociotechnical approach to IS in healthcare as discussed in the beginning of this chapter.

When introducing new information technologies in already existing workplaces, and making them a part of the already existing infrastructure, there is a lot of concerns to be taken. The amount of people and artefacts involved are immense, and it is vital that they all work together towards the same goal if the full potential is to be harvested. ANT examines the motivations and actions of the actors in such networks, and a main

feature is that actors include both human and non-human elements, such as technological artefacts (36, 37).

The theory can thus be said to deal with the investigation of the social and the technical together. It looks into the creation and maintenance of networks of both human and non-human elements where the social and the technical are inseparable and interdependent (37). We can thus use ANT to help us discover and investigate the issues in this interwoven field of research. To summarize, according to Tatnall et al. the key point of ANT is that:

> *... it explores the ways the networks of relations are composed, how they emerge and how they come into being, how they are constructed and maintained, how they compete with other networks, and how they are made more durable over time* (38, p. 959).

When the theory is applied for specific cases or projects, its main focus is to trace and explain the processes that lead to stabilization of networks of aligned interests, and how these networks is created and maintained. In cases of failed projects, it can be used to examine why such networks fail to establish themselves (37).

According to ANT, the stability and social order in networks, are continuously negotiated through the process of aligning interests. To create stability, you have to be able to translate, or re-interpret, others' interests. These interests can in turn be translated into needs. These needs might be translated into more general needs, before a solution can be made. Such a translation process might involve a designer who designs a program to fit a given scenario, and then inscribe the scenario into the program (30). The inscribed patterns of use might not be followed because the actual use deviates from it. A point to consider here is the correlation between the concept of inscription and articulation work. To not consider the amount of articulation work in healthcare may lead to incomplete inscriptions, which in turn can lead non-use of a system or solution. By examining different attempts of inscriptions, it is possible to learn more about what inscriptions that is needed to reach a certain goal. Hanseth and Monteiro exemplifies this:

> *…consider what it takes to establish a specific work routine. One could, for instance, try to inscribe the routine into required skills through training. Or, if*

> *this inscription was too weak, one could inscribe the routine into a textual description in the form of manuals. Or, if this still is too weak, one could inscribe the work routines by supporting them by an information system. Hence, through a process of translation, one and the same work routine may be attempted inscribed into components of different materials…* (30, p. 99)

A successful network of aligned interests, and implementation of a new system, is achieved through involving a sufficient number of allies and translating their interests so they are willing to participate in particular ways of thinking and acting, which in turn maintains the network (37). All actors in a network translate and shape a new technology according to their own needs. Latour stresses that this shaping of the new technology or innovation is essential for its continued existence, or in other words; essential for a successful implementation (30). When interests are aligned and all actors work together and towards the same goals, we can start talking about the creation of a *black box*. Walsham (37) defines a black box as a frozen network element. In our understanding, the black box refers to a network, or a part of a network, where all elements and relations are hidden because the network is well functioning. It is not until something doesn't work that the black box is opened again. Like all research theories, ANT has also attracted some criticism. Walsham states that one major criticism is the problem of description. If you are to describe all the heterogeneous associations between the human and non-human actors in networks, the amount of material is huge (37). It is thus challenging to comprise the material into shorter texts. We want to clarify that we will not attempt a complete description of all the actors in the EME project in this thesis, but rather draw on certain concepts from ANT to better understand our findings.

3 Method

In this chapter we will present the chosen methodology for our research of the electronic message exchange system, and how the case study was conducted. We have adopted an interpretive qualitative approach, in which interviews have been our main method of data collection.

3.1 Design and approach

3.1.1 Research design

When conducting research into the field of information systems (IS), one can chose either a quantitative or qualitative methodology, and for long, quantitative methods have been the preferred approach (39). This assumption is, partially at least, based on the opinion that pre-specified hypothesises should be tested with known variables in order to allow for a controlled experiment or statistical analysis, which would grant the most liable results (39). Within the quantitative field lays the randomized controlled trials design (RCT's), and this approach have been regarded as the gold standard, also in the field of IS research (40). This is especially true when the aim of the research is to evaluate system performance or clinical outcome. However, the focus on pre-specified variables and outcomes naturally limits the scope and field of the research. This implies that assessments of actual system use in natural settings is impeded by a strictly quantitative study design (40). It is argued that the absent of contextual focus provides objectivity and testability in the research, at the cost of a deeper understanding of the phenomenon (39). Another critique of RCT's in IS research is that the design is ill suited to investigate why and how systems are, or are not, being used, as well as explaining effects and consequences within the system's social context (41). This sparked the multi-disciplinary debate that called for more context-dependent research. In recent years, qualitative study designs, and interpretive research especially, has emerged as an important contribution to the field of IS research and are now widely accepted (40, 42). The construction of standards and frameworks for qualitative research has greatly contributed to this acceptance (42).

While quantitative research is more concerned with answering the size, extent or duration of a phenomenon, or determine that a certain intervention results in a pre-specified result, a qualitative approach is capable of revealing the *what*, *why* and *how* of a social phenomenon (41). In result, a qualitative approach is often able to identify less evident consequences. Although the two methods seem contradictory by design, a combination of quantitative and qualitative perspectives can yield deeper insight by addressing each other's shortcomings (39, 41).

For our study however, we have chosen a qualitative approach, as the aim of the research is to gain an in-depth understanding of how users perceive and experience the electronic message exchange system and what consequences that emerges. This study design will also provide the tools needed to account for both the social and organizational contexts of system use, and vice versa. As we intend to examine the dynamic process of system use, rather than its static characteristics, a qualitative method is thus preferred (43).

3.1.2 Qualitative approach

Qualitative research tries to provide new knowledge by systematically collecting, organizing and interpreting textual data derived either from talk or observation (44). It aims towards investigating subjective perspectives and behaviour of, in this case, system users within a particular situation and context (43). It also tries to understand how the context can influence processes, and conceptualize social and technological interactions in a situation (43, 45).

Kaplan and Maxwell provide five main reasons for applying a qualitative method when evaluating information systems, such as the electronic message exchange system (43). The first reason is to reveal and understand what perception and meaning users assign to an information system. This understanding can contribute to explain system success or failure. Secondly, qualitative research is useful for understanding the influence of social and organizational context on system use. As different settings will have different contextual influence, it is imperative to detect and understand what differences they have on system use. The third reason is to investigate causal processes. Qualitative research is suitable for investigating causal processes and

developing theories and explanations of events and outcomes, and why they occur. The fourth reason is that a qualitative method can provide timely feedback in both system development and implementation, identifying problems and contribute to improve the system or implementation process. It can also help illustrate how systems and organizations are mutually transformative in relation to each other. The last reason is that qualitative research can provide process evaluation that seems useful, credible and relevant to the users by connecting findings more directly with individuals' perspectives.

3.1.3 Interpretive approach

Often, no distinction is made between the terms "qualitative" and "interpretive", and they are used interchangeably. In regards to classification, interpretive research can be seen as a sub-set of qualitative research, in a manner that makes interpretive research qualitative, but does not mean that all qualitative research necessarily is interpretive. Qualitative research can be *interpretive* when the aim of the study is to produce "*...an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context*" (42, p. 3). Interpretive approaches are hence well suited for research in the IS field. The primary tool for data collection in interpretive research has traditionally been comprised of in-depth case studies and ethnographies (46). The major difference between these two is primarily the time spent in the field. Methods of data collection mainly involve interviews and observations, but Walsham points out the importance of supplementing and saturating the data with other sources as well (45). These may include documents, news articles, media and other publications, but also quantitative data such as surveys (45). The fundamental basis for any interpretive study is, however, to set up and carry out fieldwork (47).

An interpretive approach lets the researcher treat social actions and human activity in the form of text, where these actions can be seen as a collection of symbols expressing layers of meaning (48). Through interpretation of social constructs and human action, the interpretive approach provides a mean for discovering the practical understanding of said actions and constructs (48). An interpretive approach tries to understand human decision-making and behavior under the perception that knowledge

is gained through social constructions (42). This is in close comparison to general hermeneutics, which states that the understanding of new data has to rely on a pre-understanding. In terms of social constructions, these pre-understandings can be portrayed as the understanding of language, shared meanings and other artifacts (42). Gadamer further emphasizes this by stating that "*the movement of understanding is constantly from the whole to the part and back to the whole*" (49, p. 117). A correct understanding of a phenomenon is only achieved by harmonizing all the details, which implies that an overarching holistic view is necessary (49). This critical reflection does not limit it self to the understanding of the social constructions and the contextual background of the study, but also applies to our own role as researchers, in which we need to show sensitivity to both bias and distortions (42, 47). By accepting that we all are biased by our own background and knowledge, it is imperative that the role the researcher assumes is made transparent in the publication by accounting for his preconceptions that guided the original study design (42). The issue of bias is often particularly problematic in interpretive research, as there typically is a close relationship between the researcher and the research setting and participants (50). The reflective process of questioning both findings and interpretations allow us to assess the internal and external validity, but at the same time it requires a certain flexibility in the study design in order to change strategies and research questions during the study (51). This allows us to make alterations based on what is being learned about the research setting and the people in it (43).

Qualitative research can help us learn from successes and failures when applied in evaluation studies, and in that way prevent us from having to re-invent the wheel each and every time an IS is to be developed or implemented (41). By following the principles proposed, and maintaining a systematic and reflective process towards the development of knowledge, the findings can be contested and shared. If done thoroughly, new knowledge can be transferred beyond the study setting (44). In contrast to quantitative research, the aim is to obtain findings that are logically generalizable, and not probabilistically so (52). Generalization in interpretive research is also conditioned by the theoretical orientation and viewpoints of the researcher (46, 48). This implies that one narrative can be interpreted differently depending on the assumed theoretical orientation, and that all fieldwork is in essence context-dependent

(47). This is in contrast to positivist, quantitative research were there is only one assumed truth and not room for alternative interpretations (46).

Another advantage of using an interpretive approach to this study, is that the amount of necessary pre-specifications are low (53). Less pre-specifications will in turn reduce the extent of predetermined factors, and allow for more development and change in the study design (53). This would be useful when investigating how users perceive a system, such as the electronic messages, since user experience will be a subjective opinion. In regards to the stated aims of this study, an interpretive research approach is hence argued to be appropriate.

In order to account for and minimize the effect of potential bias, we have chosen to base the interpretive approach on Klein and Myers set of principles for interpretive studies in information systems (42). This will serve the purpose of providing us with a framework when conducting our study. The principles will be accounted for in its' entirety later in this chapter.

3.2 Data collection

Data for this interpretive case study were collected through interviews with actual system users and informal meetings with project managers, project members, advisors and department managers at both the hospital and the municipality. We have also used other sources of data, such as project documents, news articles, relevant literature, reports and White Papers. When conducting a case study there are several potential sources of information that can be used (54). Regardless of what method that is chosen, it is important to gather data from several sources in order to limit the effects that one interpretation of one single data source can have on the conclusion (54). This is termed information triangulation, and suggests that conclusions drawn from multiple sources of data is stronger than one based on only a single source (55).

Before we began conducting the interviews, we wrote a description of our study and applied approval from the Norwegian Social Science Data Service. We were granted approval without any objections to the proposed study design.

3.2.1 Participants and recruitment process

We identified nurses and GP's as the main user group of the message exchange system, and therefore the most appropriate professions to recruit participants from. This was determined both from literature and own experiences. Participants for the study were recruited at two different departments at the University Hospital of Northern-Norway, and two different departments at the municipal care service in Tromsø. The departments were chosen based on actual use of the electronic message exchange system. To determine the departments' actual use, we contacted project members at both the municipality and the hospital. Through these meetings we obtained information about department use; who used the system often, and who used it rarely. To saturate the nature of participating users, we chose two departments with heavy usage from the hospital and the municipality, and two departments with low usage, in total four different departments. We tried to obtain more specific statistics over actual use, but this proved difficult. We also tried to generate statistics over system use using the national massage counter. However, this was not possible since it did not hold information over sent and received messages on a departmental level. Departments were therefore chosen based on the information we got from the project members, as well as our own knowledge and experience. From the municipality we chose one department that delivered home care services, this was the department with heavy use. The other was a residential care home. The hospital department with heavy use was a medical ward, while a surgical department was the one with lower use. We contacted the GP personally and informed him about the study via e-mail, and he agreed to participate in the study.

After meeting with all of the department managers and head nurses, and obtaining approval for data collection, we began the recruitment process. By own will, all of the department managers preferred to recruit participants within their department. This was done to better plan the interviews. As we would be occupying nurses for a longer period of time, the managers would like to make sure that the nurse coverage in the departments was sufficient. We were prepared to conduct the recruitment our self, but agreed that the mangers could do it if that would ease the process for them.

To assist in the process of ensuring a good variety of participants, we developed a set of inclusion criteria that would pose as a screening tool of interested participants. We informed the mangers of the criteria. This was partially done to limit the managers' ability to influence the selection of participants.

- The participant must have had an employment relationship with the department for minimum 6 months, with a position percentage of no less than 100 %.
- The participant cannot hold any managerial responsibilities for the duration of the interview process.

We included the criteria for employment percentage and duration to ensure that the participants had been given sufficient time to get familiar with the department, work practices and the electronic message exchange system. The criteria to exclude individuals with managerial responsibilities were included to ensure that the participant did not have any interest in affecting the data either way. We acknowledge that these criteria are not enough to make the selection bulletproof, but combined with a systematic and reflective interpretation we hope to gain credibility.

In regards to the amount of necessary data, there are few concrete indications towards what is considered "enough", and this further complicates the process of predetermine the number of participants (21). Instead, we focused on conducting interviews until our findings seemed to corroborate, and incorporated a variety of voices among our participants. We therefore made sure to keep the option of returning to the department to conduct more interviews open. We did, however, agree that 21 interviews seemed sufficient when we were done.

Participants were informed that they were free to end their participation at any time, and claim exemption from the study without giving any reason. Informed consent was retrieved in the cases where participants were interviewed. Confidentiality was ensured to all participants.

We were also granted approval to conduct observations at the departments. Both managers and participants approved this on the original approval form. We did, however, not have the time to conduct any observations. This was although not experienced as a limitation in regards to data saturation.

3.2.2 Meetings

We planned and conducted several informal meetings with people involved with both implementation of the electronic message exchange system and education of users.

The first meeting we conducted was with a member of the regional project for implementation, FUNNKe. This meeting was actually conducted during the first year of the Master's program for a preliminary assignment. The second meeting we performed was with a prior project member and advisor for the municipality. In contrast to all the other meetings, this one was held at our office in the university facilities, though this did not seem to matter. The third meeting was with municipal staff, but these two where engaged with the message exchange system on a more technical level. The fourth meeting was with an advisor at the Norwegian Center for Integrated Care and Telemedicine, working with system education for users at the University Hospital of Northern-Norway. While all meetings were of an informal nature, we did prepare some topics for discussion and made written notes of what was being said.

We also made appointments with the department managers and head nurses at the department that were asked to participate. These were conducted continuously as the appointments were made, and totaled to four meetings. We informed the management at the department of our study, and also got a chance to properly introduce ourselves. Even though the intention for these meetings was to gain access and recruit participants, we found that the management had valuable inputs and strong meanings about the message exchange system. We did not audio record any of the meetings, but as with the previously, we did take notes.

The meetings with the department managers were also used to get approval for data collection. Signed copies were obtained from all participating departments.

3.2.3 Interviews

Standardized open-ended interviews where chosen to give a structured understanding of user experiences and provide uniformity, while at the same time allowing for some flexibility in probing.

We recruited a total of 20 participants, equally divided between nurses at the hospital and nurses in the municipal care service. We also conducted one interview with a GP. In total we had 21 participants in the study. Reflections on the process of gaining access to the field will be further described in the next section of this chapter.

In order to obtain a more in-depth understanding of the interviewees' opinions and knowledge, we prepared questions beforehand in order to keep some standardization between the interviews. We did, however, allow and encourage flexibility and probing in response. To reduce the artificiality of the communication in the interviews, we attempted to establish some sort of relationship and trust between the participants and ourselves before conducting the interviews. Performing the interviews at an early stage could cause interviewees to not divulge information due to lack of trust (56). Another measure to make the interviewee comfortable with the situation is to conduct the interview in a familiar environment. We therefore conducted all the interviews at the participants' workplace, and made sure that we had a room available beforehand. Participants were informed of the interviews' topic in advance. This was achieved by supplying the participants with thorough information about both the study and interview process via an information sheet distributed in advance. This was done in order to reduce the chance that answers and opinions were generated under pressure. This also gives the participants time to reflect upon the subjects, without generating specific answers in advance. Another measure to improve the quality of interview-gathered data is to ensure that there is enough time to counter the feeling of pressure (56). Therefore, participants were informed about the approximate length of the interview before we started, but we included time to allow for variation. The interviews lasted from 20 minutes to 90 minutes, averaging at about 40. Only one participant mentioned that she had a busy schedule, and that she was in quite a hurry.

Even though all participants were informed as to what the aim of the study was, and the topics for the interviews, we began all of them with an introduction of both our study and ourselves. We then proceeded with some basic questions about the participants' workplace and daily routines, before moving towards the more central aspects of our inquiry.

All interviews were audio recorded, and participants were informed about this in advance. As mentioned, the research focus may change over time, and necessary data may change accordingly. Recorded interviews allowed us to re-visit and re-evaluate the data, and determine its relevance at a later stage. We found it to be an advantage to be two interviewers; one could take notes and try to capture the tacit, non-verbal elements of the interview, while the other could fully concentrate on the interviewee. We alternated on assuming the lead and supporting role when conducting interviews.

3.2.4 Evaluation of interview process

As with much of the other study-related work, planning and conducting interviews was a new experience for the both of us. Never before had we done a qualitative study of this magnitude. We therefore spent a lot of time preparing questions and the interview template. We conducted four rehearsal interviews with acquaintances in order to better prepare and adapt our interview design and questions. We used nurses for all of the rehearsal interviews to obtain a genuine framework. After the interviews we asked the participants for feedback on both the questions and our interview technique. This was valuable input since we were new to the field of interpretive research. We altered the questions in accordance to the feedback and our interpretation of the answers we got from asking them. All of the rehearsal interviews were audio recorded and transcribed in order to give us some exercise in these activities as well.

Even though the questions and themes for the interview were carefully designed, we strived to obtain a semi-flexible design. If the questions were to rigid we ran the risk of coloring the data with our own pre-set assumptions (42). Since we both had

experiences and opinions on the electronic message exchange system from our clinical work, we tried to be particularly aware of this.

The actual interviews were conducted between October and December of 2014. We had continuous contact with the department managers at the respective departments, and coordinated the time and date for interviews via e-mail. We respected the effort they put down in organizing the interview dates, and did what we could to accommodate their wish. A few of the interviews had to be rescheduled, but this did not seem to cause any distress on either parties. Usually we conducted a couple of interviews each week. We had envisaged that the interview process would be carried out over a shorter time span, and there were periods where we questioned if we had enough time to conduct all of the interviews. However, in retrospect we see that we were well within our estimated time limit.

As stated, we began all of our interviews with a short presentation of our selves and the study, before we proceeded with some general questions about the participants' work routines and characteristics of the departments. This was done partially in order to establish a relationship with the interviewee, but also because we were genuinely interested. Starting out this way may also help if the interviewee is nervous, and may yield more revealing answers later in the interview (47). In some of the interviews we had to use quite a bit of time getting to the main themes, as the participants not always seemed to remember the routines regarding the electronic message exchange system. In other, the interviewee got to the central topics before we did. This could be challenging, but we felt we got a hold of it after a couple of attempts. The flexibility in the interview design can be as big of a challenge for the interviewer as it is a strength for the method itself. We did make some minor alterations to the interview themes and questions during the course, but the essentials remained the same. For the interview with the GP we had to make some alterations in order to make it relevant for his profession, since the others were designed for nurses. We could, however, use the majority of the questions for this interview as well, and the main theme remained the same. This was important since it would allow us to compare and see similarities in answers between the two professions.

All of the 21 interviews were transcribed using a system designed for that purpose, called expressScribe. The software allowed us to slow down the playback speed, making it easier to type without having to rewind all the time. It was also possible to easily edit out background noise. We transcribed the interviews continuously. During the interviews we took turns on either lead the interview, and ask the questions, or take notes and ask follow-up questions. The one who took notes also tried to capture the tacit, non-verbal elements of the interviews. These notes were also included as a memo in the transcribed file for each interview, and gave us more depth in the data (47).
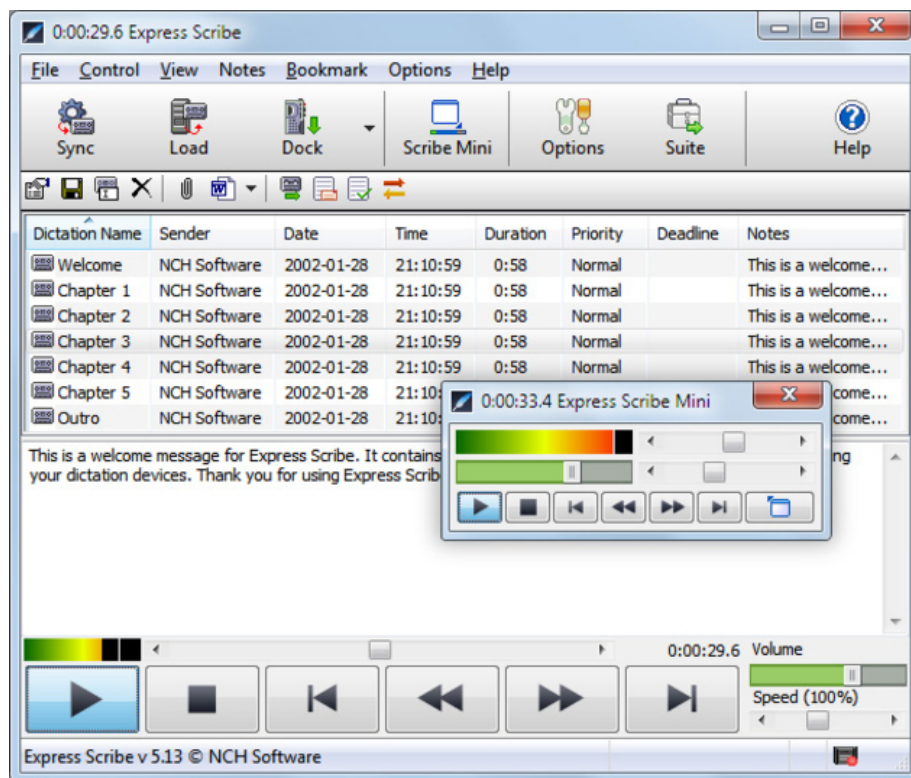
Figure 1: ExpressScribe, playback and transcription tool integrated in one system

We learned a great deal by conducting the interviews, and most, if not all, proceeded very well. We expected it to be more difficult to get participants to share, but we experienced that almost all of them willingly shared information and stories regarding the topics. We tried not to get too off-topic, but at some occasions we had to ask questions to get "back on track". We had some concern that the managers would recruit participants favorable to the ward. We did reflect on this quite a lot, but never found anything questionable. The participants were divided in opinions and did not

seem to hold back on statements that could be regarded as criticism towards their employer.

3.2.5 Analysis and data handling

After all of the interviews were conducted and transcribed, we used MAXQDA, a qualitative data analysis software, to categorize and code our data. The system also allowed us to attach different attributes, such as gender, age, and workplace to each individual interview. We began by coding five interviews individually, and then revised the codes in plenum using a projector. We discussed each coded segment of text, and negotiated until a unison understanding was agreed upon. We now had a pre-set of codes and sub-codes, with the opportunity to expand upon the previously agreed ones. We then coded all of the interviews together using the projector. This was a process characterized by continuous discussions and reflections. We coded the interviews into segments categorized by their themes, but also our interpreted understanding. This made it much easier to find specific quotes at a later time. We ended up with 950 individual segments of coded text, distributed over 61 categories. Although this was a time consuming task, we feel that it made the further analysis easier and our data more accessible.
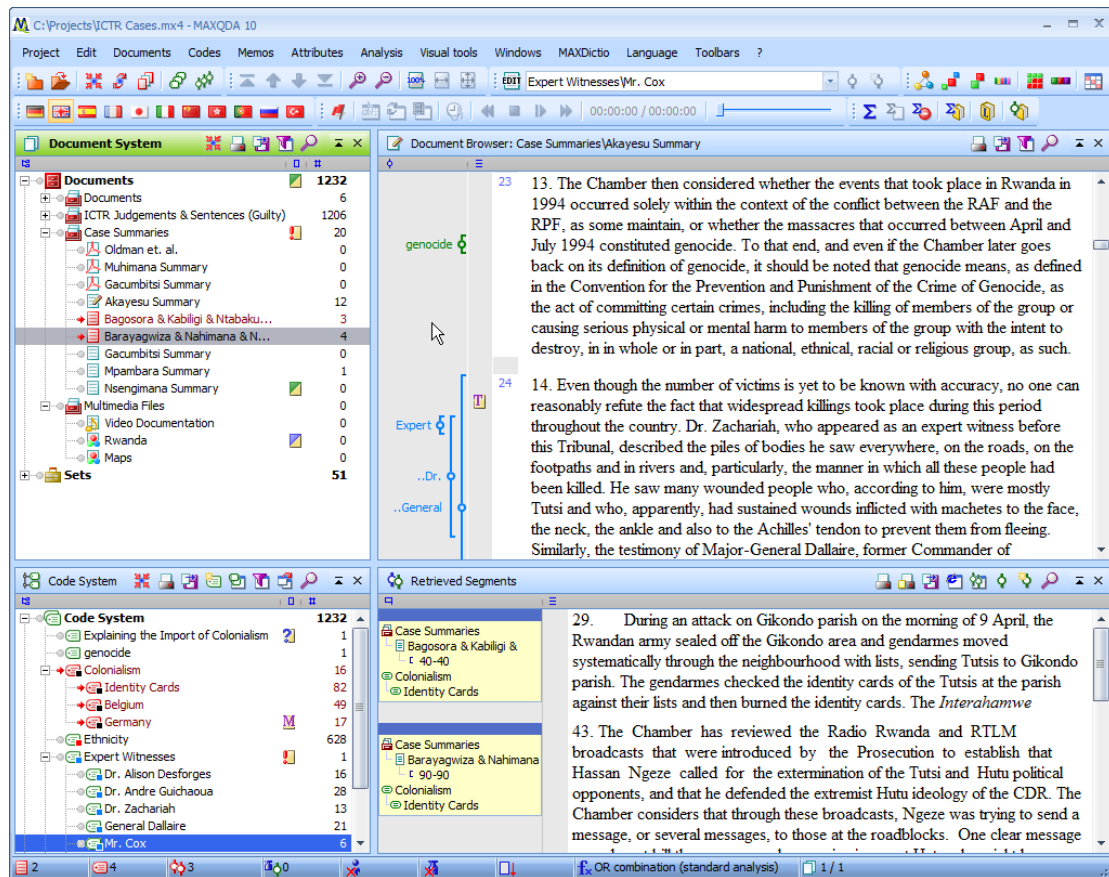
Figure 2: MAXQDA, software used to categorize and analyse interview data

In accordance with our approved application from the Norwegian Social Science Data Service, all data concerning interviewees and interviews were stored on a password protected encrypted disk. We have anonymized all identifiable data in the text in accordance to current guidelines. The data will be destroyed when no longer needed. All signed consent forms will be kept until this point.

3.2.6 Documents

Even though we are studying the electronic message exchange system in a local setting, it is important to acquire sufficient background information to see the whole picture. In order to identify and understand all the aspects surrounding its use we need to be familiar with the backdrop, and understand why the initiative were proposed in the first place. To achieve this we have used a variety of documents, from White Papers, project reports, national strategy documents and local reports. As well as providing background information and rationales, we have used them to supplement the qualitative data gathered from the interviews.

We have used the White Paper called The Collaboration reform and the national strategy for electronic collaboration, *Samspill 2.0*, to understand were the initiative for electronic message collaboration between health institutions originated from. Even though this has been subject for discussion long before these documents were released, this marks the true starting point for the electronic message exchange system. The Collaboration reform was succeeded by the White Paper "One Inhabitant – One Journal", which stated that the aim was to implement an electronic message exchange system at every hospital, municipality and GP's office on a national scale. We have used this paper to further widen our knowledge and understanding of the related processes. We have used two national reports directly related to the electronic message exchange system. PricewaterhouseCoopers did a cost-benefit analysis commissioned by The Norwegian Association of Local and Regional Authorities (KS). Even though not concerned with user perspectives, this report gave us good insight into the economic motivation and potential benefits on both a local and national level. The Office of the Auditor General of Norway also did a report on the electronic message exchange system. Their goal was to evaluate the state and scope of the implementation process, as well as simultaneous liquidation of paper-based routines.

Documents on the process of system implementation in the municipalities have been central in constructing a comprehensive understanding of the more regional and local efforts. For Health region North, the project FUNNKe has served as a competence based consultative team, and we have actively used reports and advisory documents. Documents on educational methods for users and process evaluations have been particularly useful.

3.2.7 Literature review

Since we had done several assignments on the topic of electronic message exchange prior to our master thesis we had accumulated much of the relevant literature beforehand. The scope of this study did however require us to find more detailed and in-depth information, not only on the topic of message exchange systems, but also relevant literature on theories and concepts such as Information Infrastructure,

implementation, Actor-Network Theory, CSCW and qualitative research methods, which also reflects the keywords in our literature searches. We have used relevant literature from our syllabus, from were we have derived much of the information on II's and ANT. We have used the search engine from the University Library in Tromsø for some of our literature search, but also more common sites such as Google Scholar and PubMed. The project reports and project documents were acquired through relevant webpages and direct contact with the people involved with the projects.

3.3 Reflections on the method

3.3.1 Researcher role

When conducting qualitative research, the researchers have an active role in the process, and his background and position will affect the study in multiple ways (44, 45). The angle of investigation, the findings, the framing and the communication of the conclusion will all be affected by the researchers knowledge and prejudices, and therefore influence the way it is interpreted and communicated to the reader (47). This is closely related to aspects of validity, and requires a systematic assessment of the effect the researcher have on different steps of the study. According to Malterud, these steps should be shared in the publication, and serve as a frame for the discussion of limitations and strengths, as well as the transferability of findings. Although this does not eliminate bias, it will indeed account for it (44). As Walsham argues that our knowledge of reality is based on an understanding of social constructions, the question is not whether the researcher affects the process, nor if such effects can be eliminated (47). The researchers' effects can, however, be countered by applying an agenda of objectivity to the process (44). In relation to qualitative research, this means to recognize that our knowledge is partial, and context-dependent, and adequately account for the effects we will impose on our own study. This implies clearly stating our own role and the position we have assumed as researchers.

As the both of us had been employed as nurses, and had been in contact with the electronic message exchange system in work related situations, it was important to not let our experiences and preconceptions affect the evaluation too much, and account for it were it did. In such a way, we could be seen as "insiders". We did, however,

strive to assume a neutral role, in a manner that countered the perception that we had strong prior views or interests besides collecting evaluator data, as well as avoid the risk of "going native". This is in accordance with Klein and Myers *principle of interaction* between the researchers and the subjects; namely how the data were socially constructed through the interaction between the interview participants and ourselves (42). Accordingly, we assumed more of an outsider role with insider knowledge. Forsythe argues that this approach works best, as insiders often will be blind to detecting tacit knowledge inside his own social setting (51). An outsider on the other hand, runs the risk of being excluded from information that is regarded as too sensitive or confidential for an outsider by the participants, and he therefore needs to be regarded as a member of the workplace (45). In response, we have tried to be aware of reflexivity during the interviews. This correlates to Klein and Myers *principle of suspicion*, and requires sensitivity to the possible biases and systematic distortions in the narratives collected from participants (42).

3.3.2 Gaining access

We began the process of gaining access to the clinical settings at an early stage as we had worried that this would be a time consuming and challenging phase of our study. After we had identified which departments that were suitable for inclusion, we established contact with the department heads and presented our inquiry. Contrary to what we had expected, all of the department heads were exclusively positive to our request. Walsham states that the process of gaining entry to the research setting contains strong elements of luck, chance and serendipity (47). We do, however, believe that our background as nurses worked in our favor, and helped us achieve some credibility among the other nurses. This is in accordance with Randall and Harper, who state that the fieldworker often must subject himself to the same conditions as the participants in order to gain acceptance (57). Walsham also says that the interviewer should be respected and liked by the participants (47). In this context, our background may also have contributed positively. Even though one is granted access to the setting, participants can hold back on information considered too "sacred" or off limits to outsiders, and again we argue that our background made us seem more on-level with the participants and counteracted a potential distancing (57). As mentioned earlier, the department heads took over the task of recruiting

participants for the study. This may have eased the process of gaining access by the fact that the department heads acted as "gatekeepers" (57).

The process of recruiting GP's proved more difficult than it had been with the nurses. We sent written inquiries for participation to 9 of the GP offices in Tromsø and only got one response, in which it was pointed out that participation was declined unless we could compensate financially for lost time. As we are working on a strictly limited budget, we could not avail on this offer. Walsham states that the researcher needs the willingness to accept "no" for an answer, but the persistency to try elsewhere (47), and we were eventually able to recruit one GP for our study. We had from the beginning envisioned a higher number of participating GP's, but as this proved difficult we were pleased with just the one participant.

We did propose to come back to the departments with feedback once the study was done, and all responded positively to this. We have planed a presentation about the findings and conclusion that we will present individually to all of the four departments. This will allow a two-way interaction from which both the participants and we can learn (47). Walsham states that a presentation is a preferred option compared to a report, as it is harder to say controversial or critical things in a tactful way in a static report (47).

3.3.3 Reflections on the interpretive approach

As mentioned in the beginning of this chapter, a framework can greatly improve the credibility of interpretive research. We have used Klein and Myers proposed principles actively throughout our study, and will now illustrate how they have been applied.

The first principle addresses the hermeneutic circle, and how human understanding is created by iterating between the interdependent meaning of parts and the whole that they form (42). We have used descriptive cases saturated with interview quotes as examples throughout the thesis. In a reflective and critical manner we have gone from interpreting parts of data in order to conceptualize a greater understanding of the

"whole". This process has brought to light a more in-depth understanding of the phenomena of user experiences with the electronic message exchange system.

We have tried to critically expand upon the context and background of our research setting, in accordance with Klein and Myers *principle of contextualization* (42). By giving the text the ability to convey the readers a sense of familiarity and relevance to the research, we also hope to achieve plausibility to our case (58). We have strived to portray a genuine field experience to the reader by vividly exemplifying with first-hand field experience.

In regards to the principle of interaction between the researchers and the subjects, we have provided a transparent description of how data were obtained and socially *constructed*. We designed an interview template that was used for all of the interviews, with small changes performed after the rehearsal interviews. The main limitation here were our novice and limited experience as interpretive researchers, which may have caused us to overlook, misjudge or misinterpret data. We feel, however, that the process has yielded valuable and constructive findings.

We have applied sociotechnical principles and theoretical concepts from Information Infrastructures, Actor-Network theory and CSCW in relation to our findings and data interpretation. These theoretical frameworks have guided our understanding of user experience with the message exchange system, in accordance Klein and Myers *principle of abstraction and generalization* (42).

The *principle of dialogical reasoning* requires sensitivity to the possible contradictions between our preconceptions and the actual findings (42). In response, we have attempted to be transparent and aware of our preconceptions of the system. As these presumptions may guide the initial research design, we have performed revisions throughout the process, and changed our preconceptions in accordance to the actual findings.

The *principle of multiple interpretations* emphasizes the required sensitivity to difference in participants' interpretation of the same events (42). This became clear to

us through the interview process; the experiences with the message exchange system were diverse and of a subjective nature, and users had different experiences that influenced their responses and views. The strength in the study is the number of participants that allowed for a saturated body of data consisting of multiple narratives. We have used a systematic and analytical approach towards the interpretation of data, which we hope will give credibility to the findings. This is connected to the *principle of suspicion*, the last of Klein and Myers seven principles. This states that sensitivity towards possible biases and distortions in the participants' narratives may be present. All answers will be affected by the respondent's background, and data have been analyzed to exclude potential distortions reflecting their own interest.

We believe that following a framework for interpretive research strengthens the authenticity and credibility of the study. We have tried to achieve and maintain a critical and reflective process throughout. We believe that our study gives a good impression of the user experiences with the electronic message exchange system, the research, does however, need to be seen within a specific context. It is possible that the findings and data would be different if conducted at a later time and in a different setting.

4 Background

In this chapter we will account for, and describe, the Norwegian healthcare system along with the processes that lead up to the development and implementation of electronic messages. We will also briefly define the technical basis that allows the system to function, and describe the different message types and how they are supposed to be applied.

4.1 Organization of the Norwegian Healthcare system

The Norwegian healthcare sector will face numerous challenges in the coming years, including an aging population and a rise in the prevalence of chronic diseases. This will in turn increase the burden on the system, and healthcare expenditure is expected to rise. The Norwegian healthcare system can be characterized as semi-decentralized, as the responsibility for specialist care in Norway lies with four Regional Health Authorities (RHAs) owned by the state, while the municipalities provide primary care. The system is regulated and supervised by the Ministry of Health and Care Services, and the central government is also responsible for investing in larger infrastructure projects, like the National Health Network; a prerequisite for the electronic messaging system.

The Norwegian healthcare system has in later year undergone changes in order to increase the focus on inter-sectorial cooperation while simultaneously improving resource allocation, quality issues and patient safety. Since the 1980s, the number of hospital beds has declined, along with the average length for hospital stays. This follows the substitution policy from the same time period that aimed towards replacing expensive inpatient treatments with outpatient and day-care treatment, focusing on bringing care closer to patient's homes (59). In the municipalities, however, the number of long-term beds has remained stable, in despite of a governmental ambition to increase them. Provision of home-based services has on the other hand increased (59).

After the Collaboration reform came into effect in 2012, there has been an increased focus on structural changes within the delivery and organization of healthcare. An important part of this reform was that municipalities were to co-finance hospitalizations of their inhabitants (20% of total cost), while also assume full responsibility for patients ready to be discharged from the hospitals (60, 61). Municipalities without the opportunity to accept such patients must pay day fines to the RHAs until they can accept the patient. This change in responsibility met some reluctance from doctors' and nurses' organizations, which worried that smaller municipalities would not cope with the increased administrative and economical consequences the change would entail (59).

4.1.1 Specialist care - Regional Health Authorities

Each RHA is responsible for providing specialist care in their region, and can be regarded as a parent enterprise with responsibility for the hospital trusts, i.e. their daughter enterprises (62). Inpatient care is primarily provided by the hospitals, but each RHA also have the opportunity to contract private facilities. Outpatient care is provided by the hospitals through dedicated outpatient departments. In the northern RHA, there are four hospital trusts, where UNN is one of them. In total, there are nine separate hospitals, with 250 to 4500 employees. A few years before the RHAs were introduced, a new financing model that entailed reimbursement from the state for each procedure performed at the hospital was initiated (63). This has enhanced the economic thinking in hospitals, and has led to more work in order to register every performed procedure during a hospitalization. Each year, the Ministry of Health and Care Services produces a document with guidelines, requirements and objectives for each RHA. Each RHA produces a similar document for the hospital trusts in their region. These documents impose changes and procedures to be followed by the different hospital departments and divisions. Veggeland argues that the RHAs represent a centralized, bureaucratic, top-down management model, as they possess the ability to directly affect the operation of the hospitals. He further argues that the increased bureaucratization following the reporting of results related to these objectives and guidelines may eventually lead to less time for direct patient care (62).

4.1.1.1 University hospital of Northern Norway

As mentioned in the section above, UNN is one of the four hospital trusts in the northern RHA. UNN is a decentralized hospital trust, with somatic hospitals located in four different cities in the northern part of Norway. In addition to the somatic specialist service, they also have numerous psychiatric clinics located in several different areas. In its function as the university hospital of the northern region of Norway, it covers a huge area with a scattered population, with approximately 480 000 inhabitants. UNN is also the local hospital for the inhabitants in the closest municipalities, about 190 000 people. There are roughly 5700 employees in UNN, distributed to several locations in the region, and a total of 11 clinics with just about 70 different departments (64). In the later years, re-organizations within UNN have led to several departments being combined and localized together. Our research was conducted at the somatic part of UNN Tromsø, the largest hospital of the four.
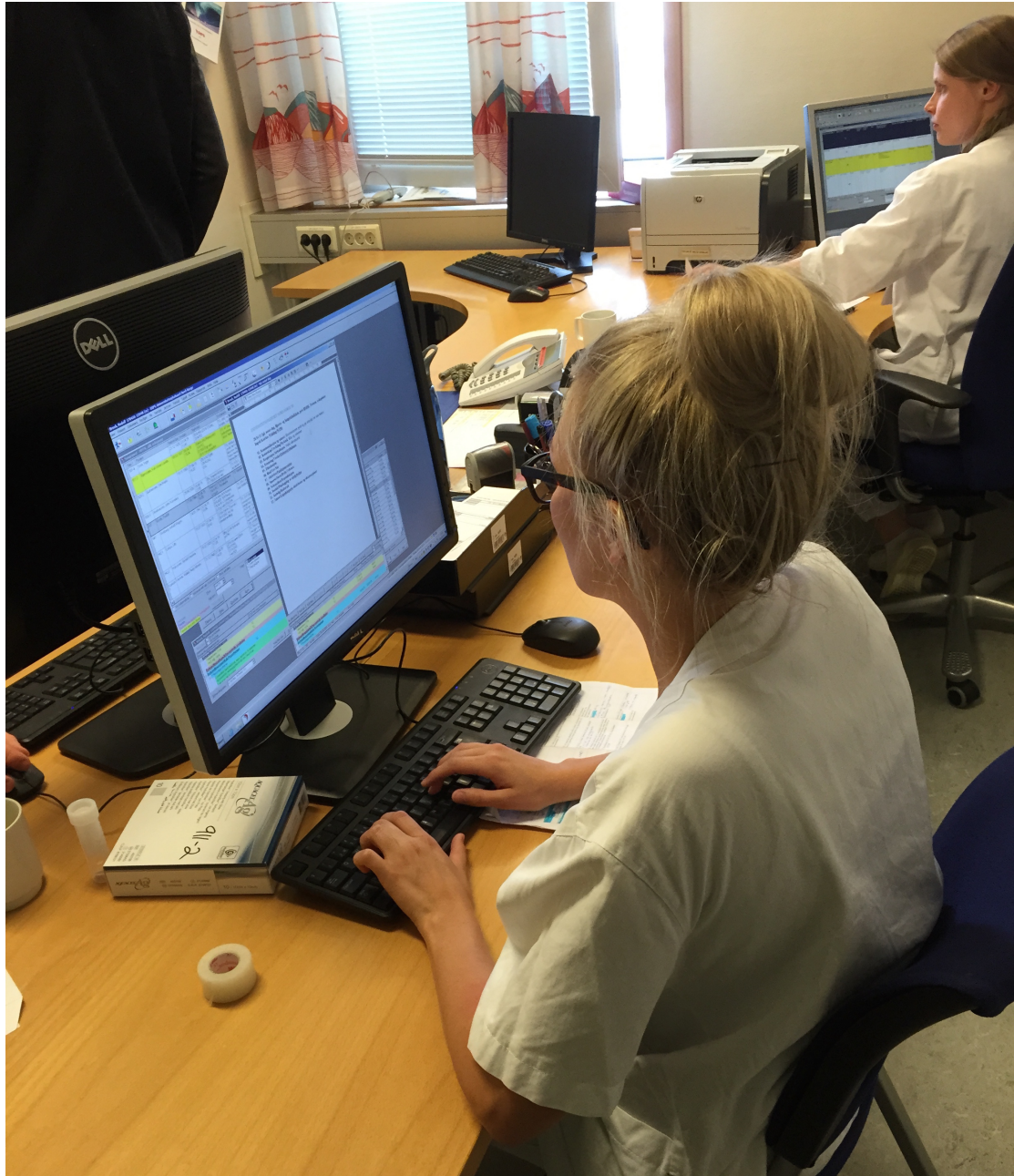
Figure 3: Typical work station in the hospital

4.1.2 Primary care - Municipalities

The municipalities provide primary care mostly through self employed physicians (GPs), and municipal public services like nursing homes and home based services. They are also responsible for the investment in infrastructures, like primary care and long-term facilities, and have a great deal of freedom to organize the health services as they see fit (59). Regular GPs also have the responsibility for emergency and acute treatment on the primary level within office hours, while on-call GPs obtain this

50

responsibility outside office hours. The GPs are seen as gatekeepers to specialist care, and are responsible for referring patients when such needs appear. In the northern RHA, there are 87 municipalities with 500 to 75000 inhabitants.

4.1.2.1 Municipality of Tromsø

In 2011, the municipality of Tromsø had a total of 68 239 registered inhabitants, with 1700 of them receiving homecare services (65). The homecare service is divided into four different overarching units, based on geographical areas. Within these units there are several smaller departments also based on geographical areas (66). In one of these units, we recruited our informants from one homecare service department, which provide care and treatment for inhabitants living in their own homes, and one residential care home. The residential care home is based on the same principle as the home care service, however, the patients have a greater need for assistance in their daily life, and have therefore been offered to rent personalized apartments located to the same building. Personnel working here are closer to the patient apartments, and can therefore provide an extended range of care services.

When a patient is in need for homecare services, the patient himself, his next of kin or hospital personnel, has to apply for services provided by the municipality. Administrative personnel then process this application, and allocate the needed services, along with an approximate timeframe for conducting it. If the patients' need for help changes, the administrative personnel has to be contacted and notified in order for the new needs to be registered.

4.2 IT in the Norwegian healthcare sector

For years, the Norwegian parliament has stressed the importance of effective information and communication tools in the healthcare sector, and ICT is recognized as an important aspect for achieving health policy objectives and goals. Health IT is frequently suggested as a means of strengthening and improving communication and information exchange within the healthcare service, and enhance collaboration between actors and providers (67). The introduction and implementation of new ICT in the healthcare sector is, however, no easy task due to the diversity of actors

involved. To best utilize new ICT, all involved actors should adopt the system(s) simultaneously (68). In today's society, patients receive treatment and healthcare from a variety of actors, which has increased the need for a coordinated service (17). This has become an increasingly problematic task to handle, as there are numerous systems aimed at various sub-services, but few that is oriented towards the whole. This is argued to partially be because of a difference in treatment goals; the specialist healthcare service is aimed at medical healing and recovery, while the municipal healthcare service is aimed at patients' function and coping skills (17).

The development and implementation of electronic message exchange between different actors in the Norwegian health system has been one of the most prioritized measures in the all of the national health strategies (69). The Collaboration reform called for a more unified and coordinated healthcare system, and pointed out that transfer of patient data and communication between healthcare actors were a main problem (17). Since 2008 the Norwegian Directorate of Health has worked towards facilitating and implementing the technical infrastructure required for standardized electronic message exchange on a national scale through the project "Nasjonalt Meldingsløft". The project was initiated as a response to the need for national management and coordination in the health ICT area, such as joint standards and technical architecture. The original project goals states that electronic exchange of patient information and data should be the main procedure for coordination and cooperation between healthcare agencies and actors by 2014, and that paper-based routines should be liquidated. The goals were later adjusted as the process proved complex and time consuming (69).

Through "Nasjonalt Meldingsløft" several regional projects were initiated between 2009 and 2010 in order to assist in the introduction of the message exchange system. These projects were a collaboration between hospitals and municipalities in the region, and was given implementation responsibilities among the corresponding actors (69). The two main projects were "Meldingsløft i kommunene" (Mik) and FUNNKe. Mik were designed to assist a total of 46 selected municipalities in implementing and utilizing the message exchange system, while FUNNKe was a regional project for the 87 municipalities and hospitals covered by the northern RHA.

The reason for initiating the regional projects was to assign the responsibilities for a coordinated implementation to a dedicated actor in each region. This is because patient trajectories and treatment will remain within the same health region in 95 % of the cases. The thought was that local, or regional, projects would assume the responsibilities for a coordinated implementation for all actors in their geographical area (68). The amount of semi-independent actors and systems requires a coordinated implementation, and the FUNNKe project was established in order to facilitate this. They would also have the responsibility to discover unintended consequences and deal with them accordingly. This is portrayed as the basis for electronic communication in the healthcare sector in the White Paper "One inhabitant – One journal" (68). Although FUNNKe is assigned the task of propagating the message system in the region, each actor is responsible for acquiring the necessary ICT solutions.

"Nasjonalt Meldingsløft" was officially terminated in 2011 when the Norwegian Health Network, a government agency, assumed the monitoring responsibilities for future development. While Mik ended simultaneously, FUNNKe was continued as a regional project. "Nasjonalt Meldingsløft" was succeeded by a new project called "Meldingsutbredelse". The major goal remained the same, but the timeframe had been extended as a result of prior experiences (69).

Communication Message type	Hospital - Hospital	Hospital - GP	Hospital - Municipalities
Discharge summaries	2011	2010	2012
Referrals	2011	2010	2013
Care service message	-	-	2013

Figure 4: Timeline goals for message exchange between actors

The main task for the Norwegian Health Network was to coordinate the message exchange system propagation and serve as an advisory body for hospitals, GP services and municipalities. The effort to develop shared standards for messages had been an

on-going process. In the new project, message exchange between hospitals and GP's had the highest priority, while exchange between hospitals and municipalities had the lowest (69). This was because the municipal-hospital message standard was incomplete at the time of the project.

Timeline for electronic message exchange in Norway

- 1997 (Nationwide): Electronic exchange of health information presented as a political goal.

- 2005 (Nationwide): Due to the lack of national initiatives, NSF and KS initiate the ELIN-k project. This project was aimed at developing and piloting standardized solutions for communication between the municipal care-sector, hospitals and GPs. Ended in 2011.

- 2008 (Nationwide): Establishment of the program: "Nasjonalt Meldingsløft" to help realize the potential of earlier national initiatives, like infrastructure and established message standards. Ended in 2011.

- 2008 (Local): FUNNKe started as a local, pilot project at the Norwegian Centre for Integrated Care and Telemedicine aimed at supporting the electronic communication between UNN and the surrounding municipalities.

- 2010 (Nationwide/local): Introduction of a strategic program to speed up the implementation by the Norwegian Health Authorities, called Meldingsløftet i kommunene (Mik), to help follow the goals of Nasjonalt Meldingsløft, as well as aiding the selected municipalities more directly with implementation and grounding of the system. Ended in 2011.

- 2010 (Regional): The FUNNKe project received 23,3 million NOK in funding to expand the project to include all 87 municipalities in the region, as well as the four hospital trusts. The timeframe was 3 years, 2010-2013, but has later been expanded to include 2014.

- 2010 (Regional): The FUNNKe project becomes the regional part of the national Mik-project.

- 2012 (National): The responsibility for implementation of electronic messaging shifts from the Norwegian Directorate of Health to the Norwegian Health Net SF (NHN), and the project Nasjonalt Meldingsløft is officially ended. NHN establishes a program called Meldingsutbredelse aimed at establishing electronic communication between the municipal healthcare, hospitals and GPs. One of seven projects in this program is called Kommunal Meldingsutbredelse (municipal message-distribution, KomUT) for the time period 2012-2014.

- 2012 (Regional): FUNNKe becomes the regional part of the KomUT project.

4.3 FUNNKe

According to the project description at the Norwegian Centre for Integrated Care and Telemedicine, FUNNKe started as a pilot project in a smaller region of Northern-Norway in 2008-2009 (70). This pilot project resulted in 4 million NOK in funding to UNN from the Norwegian Directorate of Health in order to support the implementation of electronic message exchange between the municipal health service in the region and UNN in 2010-2011. According to a project member, the northern RHA got engaged at this point, wanting to expand to include the whole region (personal communication, 06.11.13). An application was thus sent to the Ministry of Health and Care Services, and in 2010, the northern RHA got 23,3 million NOK in funding to expand the project to include all 87 municipalities in the region, as well as the four hospital-trusts. The projects timeframe was initially three years, but later expanded until 2014.

The project is lead by the National Centre for Integrated Care and Telemedicine at UNN. The project group also consists of representatives from the ICT section of Health Region North, UNN and local project managers from the 17 collaborating

municipalities. The funding is distributed between FUNNKe and the participating municipalities and hospitals.

In January 2012, the Collaboration reform was set into motion in Norway. A big goal in this reform was to improve and develop the collaboration between the different levels in the Norwegian health service (17). A report from 2012 by PricewaterhouseCoopers concluded that the implementation of an electronic messaging system on a national scale would lead to increased quality and collaboration (71).

4.3.1 Project goals

In the application for funding from 2010, it is stated that the objective of the project is a health region where quality and efficiency is promoted through expedient collaboration and coherent patient trajectories. To reach this objective, the municipal health service and the hospitals are to adopt electronic message exchange that is built upon the already existing standards and infrastructure. Another objective was that the northern RHA should function as a showcase and a pioneer in the field of electronic message exchange, and that the knowledge and experience gathered related to implementation should circulate and be used by the remaining health regions in the country (72).

There were also some more specific main goals that were to be reached before the end of 2013. They were as follows:

- All municipalities in health region north should be connected to the national health-network.
- All municipalities and hospitals are to use electronic messaging exchange between:
  - The municipal health and care services and the general practitioners.
  - The health centres and the hospitals.
  - The municipal health and care services and the hospitals.

- The organization FUNNKe shall share its competence and knowledge with the other health regions in Norway.

4.3.2 Implementation strategies

From the same project document as mentioned above we find that the implementation strategies for the FUNNKe project builds upon five principles:

- Grounding on a regional and municipal level.
- Free access to expertise.
- Organization of local networks (inter-municipal collaboration and collaboration between the hospitals in the region).
- Sharing of experience and knowledge.
- Subsidies.

It is specified in the funding application from 2010 that FUNNKe was to contribute with consulting and coordination of work related to secure network establishment, the purchase of software, upgrading of existing systems and the training of health personnel in the use of electronic message exchange. The work set in motion by FUNNKe was to follow the national distribution project "Mik" (72). The plan was to engage the local hospitals and the municipalities in a coordinated implementing process. FUNNKe was to function as a decentralized competence organization. A key aspect of the implementation process was thus to create local networks of knowledge in the different regions with a collaborating municipality dedicated to aid the surrounding municipalities.

4.4 Technology and message types

In this section, we will briefly describe the most important technical aspects of the electronic messaging service as presented in a local risk analysis of electronic message exchange in Northern-Norway from 2013, and a report prepared by the Office of the Auditor General of Norway in 2014 (69, 73). In addition, we will give an introduction to the messages and their application areas, as it is important to create a contextual framework to support the understanding of our findings presented in the

next chapter. By presenting the technical aspects of the electronic message exchange system, we are hoping that you as a reader achieve a clearer understanding of our case, which may lead you towards a broader sociotechnical view of our findings.

4.4.1 The National Register of Electronic Addresses

The most common municipal service areas are the health and care services (home based care, nursing homes), the medical service (general practitioners), the mental health services and administrative health services. Specialist health services for each region are provided by the RHAs through the hospitals. All the service areas have to register their electronic and physical addresses into the joint National Register of Electronic Addresses maintained by the Norwegian Health Network, an organization owned by the Ministry of Health and Care Services (74). In addition to manage the address-register, they hold responsibility for the health network, which is the public infrastructure for sharing and exchanging health related information between the different users and institutions in the Norwegian health and social service sector. Connection to this secure network is a prerequisite for the exchange of electronic messages.

The organization of municipalities in Norway varies greatly with their size, and smaller municipalities often have fewer areas of service than large ones. One example is the municipal emergency centres; these are often centralized to one municipality, though utilized by several of the surrounding ones. However, it is only registered as a service in the host municipality. The municipalities must choose what services they provide and want connected to the electronic messaging system, and are themselves responsible for updating and making sure that the addresses are correct, so that messages from other organizations, e.g. a hospital, reaches the correct service.

4.4.2 Message types and their application

There are two main types of messages: *basic messages* and *nursing and care messages* (NUC-messages). The basic messages are referrals, discharge-notes and requisitions (blood samples, x-rays) and replies to these requisitions. These messages have been exchanged between hospitals and general practitioners for many years, and

are now also being adopted by the health and care service. The messages primarily used by our informants, and which thus receive most attention in this thesis, are the NUC-messages, which are made for communication between the municipal health and care service on one side, and the hospitals and the GPs on the other. There are three main types of NUC messages: logistic messages (to communicate administrative information regarding a hospital stay, discharge from the hospital and so on), dialog messages, and professional messages (to communicate/request medical information and answer requests from GPs/nurses). Messages are exchanged between senders' and receivers' EPR. There are several different systems in use in the different municipalities of Norway, whereas most of the hospitals have now acquired the electronic patient record "DIPS", from the Norwegian vendor with the same name (75). To exchange the messages, both the sending and the receiving EPRs must be technically prepared. This implies that the current version of the electronic message type is implemented and tested in the different actors EPRs, as well as approved by the Directorate of Health. Some of the messages are automatically generated from the information found in the EPR, and it is therefore essential that documentation of patient information is conducted in a proper manner. Despite there being national guidelines and standards for electronic messages, there have been several local adjustments made in the northern RHA.

Following is a description of the different message types used in the northern RHA:

- **Basic messages** – Primarily used between the hospitals and the GP, although about to be implemented in the health and care service
    - **Referrals**
    - **Discharge – notes**
    - **Requisitions – for laboratories or x-rays**
    - **Answers to requisitions**

- **NUC-messages**
    - **Logistic messages** – Sent from hospitals to the health and care services in order to safeguard the transfer of administrative information related to hospitalization, the planning of discharge and the actual discharge.

These messages contain no health information, and only accounts for the name of the patient, relevant dates and the nature of the patient situation. Contains no free text, and are automatically generated when certain variables in the EPR are confirmed and the nurse checks off to notify the health and care service.

- **Admitted patient** – Sent as soon as a patient is admitted.
- **Patient ready for discharge** – Sent as soon as a patient is regarded as ready for discharge.
- **Cancellation of patient ready for discharge** – Sent if the patient's situation changes, and is no longer ready for discharge.
- **Discharged patient** – Automatically sent when the patient is registered as discharged from the hospital.

o **Dialog messages** – In order to support communication between health personnel on different healthcare levels. They are open in structure, and content must be written in free text. The name of the patient is automatically included, and there are several subcategories to choose from to indicate the purpose and content of the message. These messages can be sent and received by all three actors, and may contain health information or other practicalities needed to ensure the cooperation between the health-levels.

- **Request –** Message with several subcategories used for communication regarding a patients status, need for services and so on. Can be sent between the health and care services and the hospital/GP.
- **Answer to request –** Used to answer a request.
- **Exception message –** Used to report insufficient information or deviations from message routines.

o **Professional messages –** These messages has numerous textboxes and check off boxes. The sender can choose what information from the EPR the message is to include. Also contain spaces for free-text. Some

messages are sent between the hospital and health and care service, and some are sent between the GP and health and care service.

- **Admission report** – Sent from municipal health and care service to the hospital as an answer to the message "notification of admitted patient". Should contain medical and personal information, eventually information regarding to the cause of hospitalization.

- **NUC Health information** – Used as an early alert, supposed to be sent from UNN within 24 hours of admittance, containing information about patient status, expected course of treatment and expected discharge date. Also used at a later stage when there is new or increased need for municipal health and care services.

- **Health information for GP** – Sent from health and care service to GP.

- **Medical information** – Sent from GP to health and care services regarding medical information about the patient.

- **Drug information** – Sent from GP to health and care services about patient's drug administration.

- **Orientation of service needs** – Sent from health and care services to GP.

- **Orientation of death** – Sent between health and care services and GP.

There is yet another professional message supposed to be sent when a patient is discharged from the hospital called Discharge report. This message is supposed to contain medical information about the patient, information regarding treatment carried out during hospitalization, future treatment plans, medicine list and so on (76). According to a former project coordinator in FUNNKe, the message is still not in use due to a poor user interface and low security levels regarding pharmaceutical information (personal communication, 10.02.15). For this reason, it is replaced by a discharge summary. In the guidelines regarding electronic messaging in UNN, these summaries are supposed to be sent physically with the patient upon discharge, while

an electronic copy is sent to the service provider and the GP (77). It is as such not an electronic message in nature, but an electronic copy of the document sent through the same system, and received in the same inbox as the electronic messages. The main idea is that the electronic copy should reach the service provider before the patient arrives, to ensure that home care is updated on the patient's medical situation and needs.

4.4.3 Message flow

To ensure a proper level of control, the systems are made to send transport and application receipts for each message sent. Every organization (hospital, municipality, GPs office) must have routines for surveillance of the message traffic to ensure that faults and deviations are discovered and fixed as soon as possible after its occurrence. There must also be routines to follow up that messages reach the correct recipient, and that the messages are processed within the timeframe.

When a message is sent, it is processed in a broker (translator), which is placed between the EPR and the messaging server. These brokers make the messages available for the EPR by transporting them to and from the messaging server. Some messages are automatically filled with patient information, whilst others need manual entry of data. One prerequisite for electronic message exchange is that the both the sender and the receiver uses updated certificates for encryption. These certificates are available in the National Register of Electronic Addresses. The message server processes the messages before they are sent out on the secure health network.

After an approved arrival of a message in the receiving actors messaging-server, a positive transport receipt is automatically generated and sent back to the sender in order to assure the sender that the message is received in the recipient's messaging server. When the message is processed in the receiving actors messaging-server, it is sent on to the receiving actors EPR, and a positive application-message is generated and sent back through the same system, to the senders EPR. These application-messages gives the sender assurance that the message has been received by the receiving actors EPR, and that it is in a format that can be read by the recipient. If there is something wrong with the message, e.g. that XML isn't validating, it cannot

be transferred in to the recipients EPR, and a negative application-receipt is sent to the sender.

In the municipality, the personnel at the service area that delivers the care (e.g. a department at a nursing home or a specific home care service) is granted access to the patient's journal. If the patient moves permanently from the home care service to a nursing home, the access is changed to the health personnel at the specific department in the nursing home. If the patient goes for a short stay in a nursing home, e.g. for rehabilitation purposes, the healthcare personnel in the home care service and at the nursing home can both have access to the patient's journal. Access to the electronic message-exchange module is primarily given to nurses and doctors. The same principle for access applies when a patient is admitted to a hospital. The personnel at the department the patient is admitted to have access to the patient's journal and electronic messages. If a patient is moved to another ward during the hospital stay, access to the journal and the messages follows.
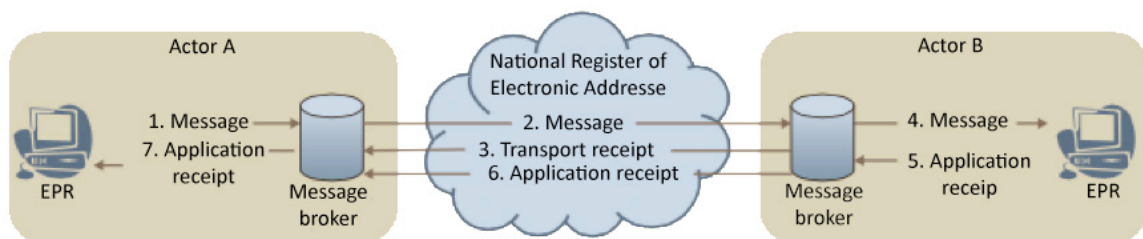
Figure 5: Message pathways

Below follows a summary of the process of sending and receiving messages as illustrated in figure 5:

1. **Actor A** chooses the message type and performs a search in the National Register of Electronic Addresses to find the correct recipient. The senders EPR deliver the electronic message to the senders messaging server.

2. The messaging server processes the electronic message before it is sent out on the secure health network.

3. When the electronic message is received in the messaging server of **Actor B**, a transport receipt is sent back to **Actor A**.

4. The electronic message is processed in the messaging server of **Actor B** before it is sent on to the EPR of **Actor B**. The EPR automatically generates an application receipt, which is sent back through the messaging server.

5. The application receipt is sent over the secure health network, through the messaging server and back to the EPR of **Actor A**.

4.4.4 Message handling in the municipality of Tromsø and UNN

In communication between the municipality of Tromsø and at UNN, it is still not possible to address the messages directly to a hospital department or a specific home care service. There is only one address for the entire municipality, and one address for all of UNN. Through personal communication with a former project coordinator in FUNNKe, it emerged that direct service addressing is under preparation, and estimated to be adopted within the end of 2015 (personal communication, 10.02.15). Today, the messages follow the patient's registered location, and the workers who are granted access to the patient's journal also have access to send and read the electronic messages. This is in contrast to communication between the GP and the municipality, where both actors have the possibility to send the message to the service they want to reach. The GPs can choose to send a message to an administrative caseworker at the allocation office, or directly to a specific home care service.

The access to patient's individual inboxes is controlled through the access-settings in the system. Messages intended for patients who is not already registered in the EPR is only readable for personnel granted a special access. These messages can include notification of service needs for new patients or misdirected messages. All municipalities must establish routines for how such messages are to be treated. Someone *must* have access to all messages in the inbox in order to operate the message monitoring and evaluate the messages regarding new or unknown patients. Access to all messages in the inbox discloses health information about patients the person does not have responsibility for, and should thus be given to a limited amount

of people. In the municipality, this access is granted to dedicated administrative personnel located to the allocation office. The person with access to the inbox can transfer messages to the health-personnel that have responsibility for the patient. When messages is read and processed in the correct way, some EPRs allow direct storage in the patient's electronic journal.

The municipality of Tromsø have centralized the administrative aspects of the health and care services to the allocation office (tildelingskontor in Norwegian). When a patient has new home care needs, e.g. after a hospital stay, the hospital or the GP sends an application for services to the municipality that must be processed by administrative staff at the allocation office. They are then to allocate new services to the patient, while they at the same time inform the appropriate home care or nursing home about the change. If the patient's need for help is considerably higher than when he was admitted, or he needs more complex services from the municipality, meetings between the allocation office, homecare personnel, hospital personnel and the patient can be arranged prior to discharge.

However, due to the lack of service addressing, the municipality's system is configured in such a way that all messages regarding a patient are readable for both the administrative personnel at the allocation office as well as the nurses in the home care service, regardless of whether it is a message concerning increased needs for the patient or just general medical information intended for the nurses in the homecare service. In other words, there is one joint inbox for all messages for each patient. Nurses and administrative personnel must therefore know in advance which messages they should process, and be aware of this when new a new message arrive in the inbox. Guidelines and documents are designed to ensure the distribution of responsibilities regarding the different messages. One of these documents meant for the allocation office in the municipality of Tromsø, states that several messages is supposed to be open and controlled by the allocation office, but processed and answered by nurses in the care service. Another example is the dialog message sent from UNN to the municipality where the allocation office and the care service must agree upon who responds in each individual case (78).

When a message arrives in the hospital system, it is placed into a "working group", which can be looked at as an electronic mailbox. A message about an admitted patient is made available in the working group of the staff caring for the patients. If the patient is not admitted, e.g. if the home care service wants to prepare the hospital for a planned admittance, the message ends up in an undefined work-group. The system is not able to process such messages automatically, and it has to be handled manually and moved to the correct department's working group.

Another important aspect of the electronic messaging service is the monitoring and management of errors. The sender is always responsible for making sure that the message has reached the correct recipient by monitoring the status of receipts. When a message doesn't reach its recipient, the problem must be fixed, and measures taken so that future messages reaches the correct recipient. All steps of the message transfer have to be monitored. In the municipalities the personnel dedicated to monitoring and management of errors is located to the allocation office. In the hospitals, the ICT department of the northern RHA is responsible for the transport receipts, whilst the departments themselves are responsible for the application receipts. We will not go further into the process of monitoring errors here.

4.5 National status for electronic message exchange

By October 2013, 421 out of the total 428 municipalities were connected to the health network, but only one third reported that they used electronic message exchange between their care service and collaborative hospitals (69). Municipalities participating in FUNNKe or Mik had a higher rate of use, but they also reported that municipal care services were behind schedule.
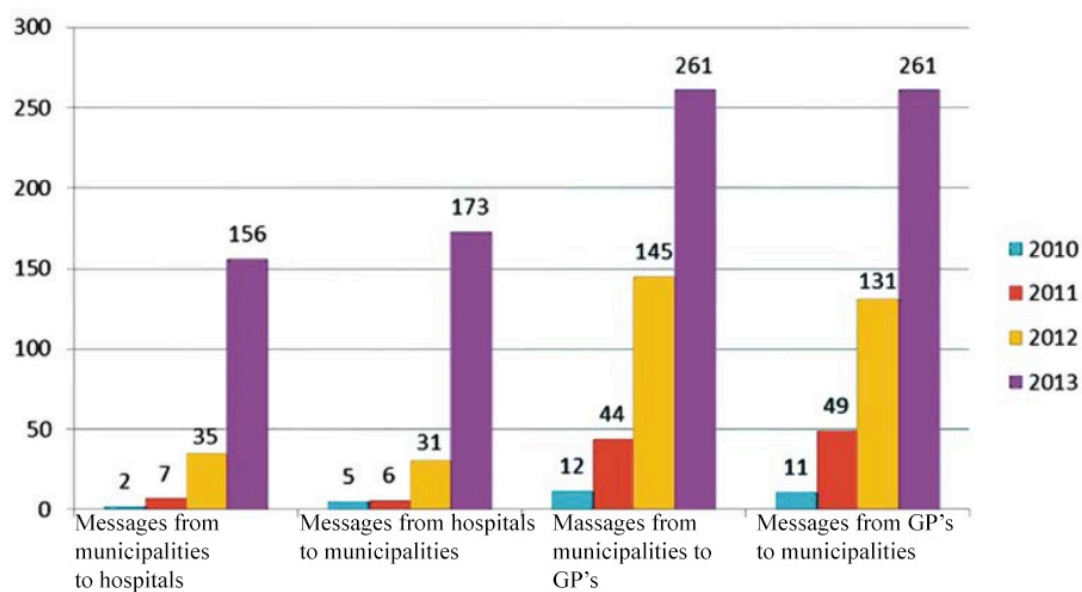
Figure 6: Number of municipalities with electronic message exchange system for selected message types 2010-2013

The majority of hospitals exchange electronic messages and referrals with GP's, but some vary between either paper-based or double routines, meaning both electronic and paper-based. The Office of the Auditor General of Norway (2014) points out that some of the messages are sent with locally or regionally adapted solutions and not national standards. Health Region North stands out in comparison to the rest of the country, as almost all referrals and requisitions are sent and received electronically (69). The majority of municipal care services in the northern RHA are also connected to the health network, and able to send and receive messages electronically. This was however not enough to meet the goal of full electronic message collaboration by 2014 (69).

4.6 Prior research

There has been conducted some research into the use of electronic messages and how it affects communication and cooperation between actors in the healthcare services, but for the most part this has been centred in the southern part of Norway. Although relevant, the northern part faces different challenges due to the geographical nature of the region and its scattered population.

Hellesø and Melby tried in their study to identify how the electronic messaging system affected collaboration between homecare services and GPs, and if there were any unintended consequences after it was introduced (67). As with the rest of the country, communication and information exchange was previously predominantly done orally or via telephone and fax, in addition to face-to-face meetings. The already existing IT systems did not allow for information exchange across organisational boarders since they were incompatible with each other, and the homecare service had little access for electronic communication with their collaborative partners (67). This resulted in slow and fragmented patient information exchange, and healthcare personnel found it challenging to contact each other. After the implementation of electronic messages the homecare personnel reported that information and communication were made more easily accessible and enabled a better overview of patient information (67). The homecare staff also felt that their opinion had more weight when communicated through electronic messages, as they automatically would be documented in the EPR. They also felt that it had contributed to increased professional networks and knowledge about each other (79).

In another study by Hellesø and Melby the homecare staff emphasised the importance of receiving updated patient information in advance of discharge from the hospital (79). This would allow them to prepare sufficiently for the transfer of patients, and increase their sense of predictability. They found, however, that information were not exchanged in advance of the patient's transfer, even after the hospital had been able to send information electronically for over a year (79). They argued that one reason was a lack of proper routines to support the information exchange, and that organisational changes were needed in order to make the system work in an optimal way, and that these issues outweighed the technical ones (67, 79). The prior research is somewhat divided on user satisfaction in regards to technical usability and functionality (67, 79). Users stated that using the electronic messages for communication would constrain some of the flexibility they had with traditional methods of communication (79). Staff said that comprehensive and timely communication was important, and even though content quality and frequency of communication seemed to improve with the messages, it did not lead to timelier communication (79).

Another problem they found was that both home care services and hospitals were connected stepwise to the system, resulting in that both traditional communication practices and communication with electronic messages existed side-by-side (67). This also led to confusion for both senders and recipients, as they had to manage different work processes for the same communication procedure (79). The fact that traditional methods of communication is used even if the electronic message exchange system implemented indicates that the electronic messages is complementing the existing methods rather than replacing them (80).

5 Findings

In this chapter we will present what we deem to be our most important findings derived from both interviews and various documents. Due to the complex nature and integration of the EME system into various work-processes, it is only natural that our findings are equally complex. They are diverse in the sense that they stretch into a variety of areas, from what motivations lies behind use of the system to more concrete technical and organizational issues that can potentially affect system use.

We start by presenting how users experienced the training and educational strategies within their respective organizations, and how this affected system usage and routine compliance. We then go on to explain how certain features of the EME system seemed to more or less coincide with the existing work practices found in the diverse and different organizations. We also present how the organization of work and certain organizational aspects seemed to affect how useful the system was conceived to be. Introduction of the system had caused both expected and unexpected consequences that users had to deal with on a day-to-day basis. The new collaborative routines were not always followed, and could cause challenges across organizational borders, affecting both healthcare personnel and patients. The number of communicating municipalities also seemed to create several routines for hospital users, which further complicated the compliance to new routines. The chapter ends with an issue that can be seen in a broader perspective, namely the tension between informal and formal communication in healthcare. Our informants had a nuanced viewpoint on this, and informality in communication seemed important for a reliable transfer of clinical information across health levels.

The figure below represents the electronic message exchange as it emerges from our findings. It does not necessarily correspond with the intended routines, but rather illustrates how the system is actually used by end users. The four main actors are represented, but we do not differ between different hospital and municipal departments in this figure.
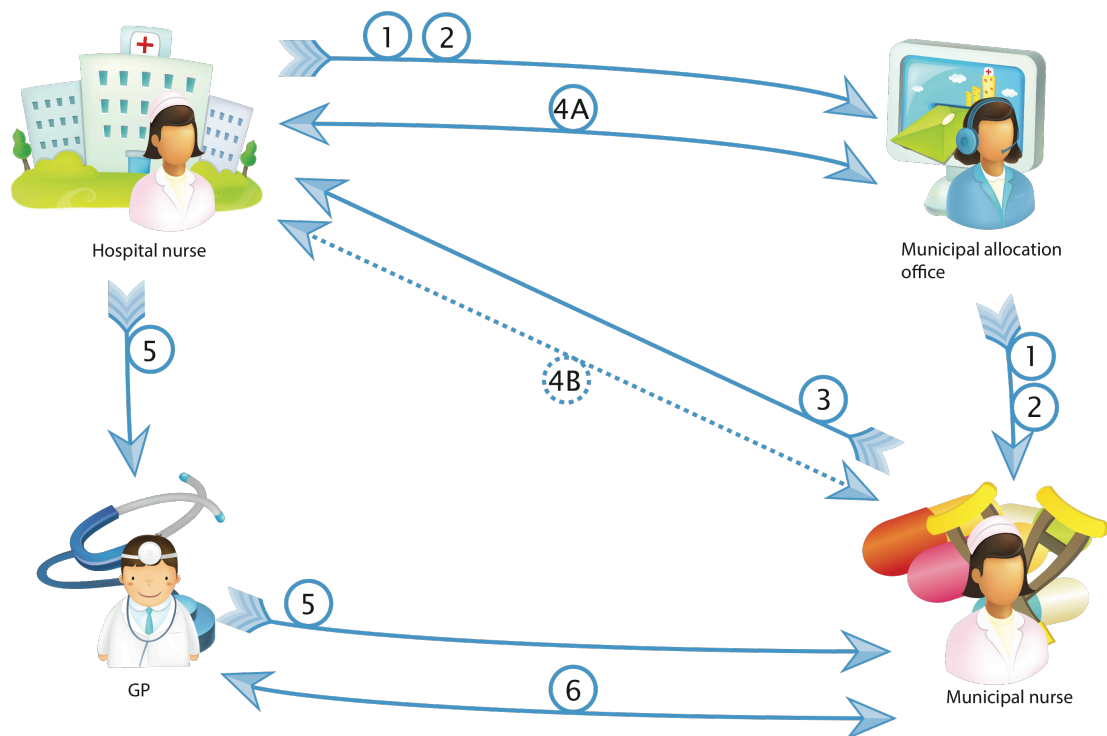
1. Automatic message of admission
2. Early alert; estimated date for discharge
3. Admission report
4A. Dialog, administrative information and coordination
4B. Dialog, clinical information
5. Discharge summery
6. Dialog

Figure 7: Message flow with explanation

When a patient is admitted to the hospital, an electronic message is automatically generated and sent if the patient is registered with existing municipal care services. The message Admitted patient, represented by the number 1, is sent to both the municipal allocation office and the home care service. This message's function is to alert the municipality, informing them that one of their patients has been admitted to the hospital. After admission, the hospital nurse responsible for the patient has 24 hours to send an Early alert ("tidligmelding"), represented by number 2. This message is also sent to both the allocation office and the home care service. The hospital nurse

is obligated to provide the municipality with an estimated time of discharge in this message. The nurses expressed that this message rarely contained valuable information, and it was deemed to early for them to actually estimate an accurate discharge date. When the municipality receives this message, they are to respond with an Admission report (arrow 3), supposed to contain information about what led up to the admission, and a selected summary of the patient's clinical and medical information. Due to the lack of updated information in the municipal EPR, municipal nurses often described the message as incomplete. They also worried that outdated information that automatically was included could be a source of error. Some hospital nurses told us that this message often came too late to be of value, while others reported that they never had seen it.

Arrow 4A represents the Dialog messages between the hospital nurse and the allocation office. These messages are primarily of an administrative nature, and used for coordinating meetings between the municipality and hospital prior to the discharge of the patient. The municipal nurses can read these messages. Arrow 4B represents the Dialog message function between the hospital nurses and the municipal nurses. This is a function that is rarely used, and communication intended for these messages is often performed over the telephone. This is somewhat paradoxical, as both hospital nurses and municipal nurses requests such a function.

Arrow 5 represents the Discharge summary from the hospital. This is generated by the hospital nurse, and sent to the patients GP and home care service. This is the last message that is exchanged between the hospital and the municipality. Municipal nurses stated that there was inconsistency in how they received this message, and that this affected how prepared they felt when patients were discharged. Arrow 6 represents the Dialog messages between the municipal nurses and the GP. This message is frequently used, and appreciated by both nurses and GPs.

5.1 User experiences of training and educational strategies

5.1.1 Lack of organized training in the hospital

The hospital Department for e-Health and ICT Management initially arranged training sessions for users in the hospital. Each department could send nurses to a two-hour educational course, where the goal was to educate super users that would train the rest of the staff at their department. The training was practically oriented were the instructor would demonstrate functionalities in the system, as well as provide a review of the development and implementation processes. When asked about it, some of our respondents said that they had attended an introduction course when the system was initially introduced. However, others stated that there had been little structured training at their departments. One of the nurses at the hospital told us that she was a super user in electronic messages, supposed to aid the other nurses at the department:

> I was just chosen to be the super user, I have learned it (how to use the message system) myself. I haven't had any training. Previous we had two super users, but they quit. I volunteered, me and another nurse. But we haven't had any training, so what I know I have learned myself.

She often had the responsibility to teach new employees in the use of electronic messages, and stated that she did not have the knowledge to answer all the questions that were raised at these teaching sessions. The "FUNNKe i UNN" report states that the responsibility to educate and train new staff rests with the department heads, and that the initial tough was that super users should facilitate this (81). Respondents at the other hospital department also felt like there had been a lack of training with the electronic message system. One of the nurses from the inpatient surgical department stated:

> When it first came we had a brief rundown with the head nurse. We went quickly through what this was, and what we had to do if we had patients admitted that needed services from the municipality later on. So we had some training in filling out that specific message.

Even though some of our respondents reported that they had received some training, the majority expressed that it was insufficient in order for them to feel comfortable with the system. One hospital nurse stated that you had to take initiative and learn

from someone else: *"It is up to each individual. When you hear that someone are going to send an electronic message you have to say "hey let me see how it's done", and ask along the way. I think the whole staff is self-taught".*

At the time when we conducted the interviews, the hospital had initiated an e-learning course on the electronic message system and related routines. This was a mandatory course. One of the hospital nurses that had completed the course had this to say about it:

> *What I miss is some proper training in the use of the electronic message system. The e-learning course that is being flung out to everybody is not good enough. It was really difficult. We should have had some sort of lesson or education before we had the e-learning course.*

This was a consistent opinion among the hospital respondents; the e-learning course was not enough by itself, and they missed a more general understanding of the system. When asked about her training, one of the nurses from the inpatient medical department stated: *"I have requested it, because I really want to go if there are any courses. Because it is not certain that all that I have learned myself is entirely by the book. That is what I experienced with the e-learning course, since I failed it".*
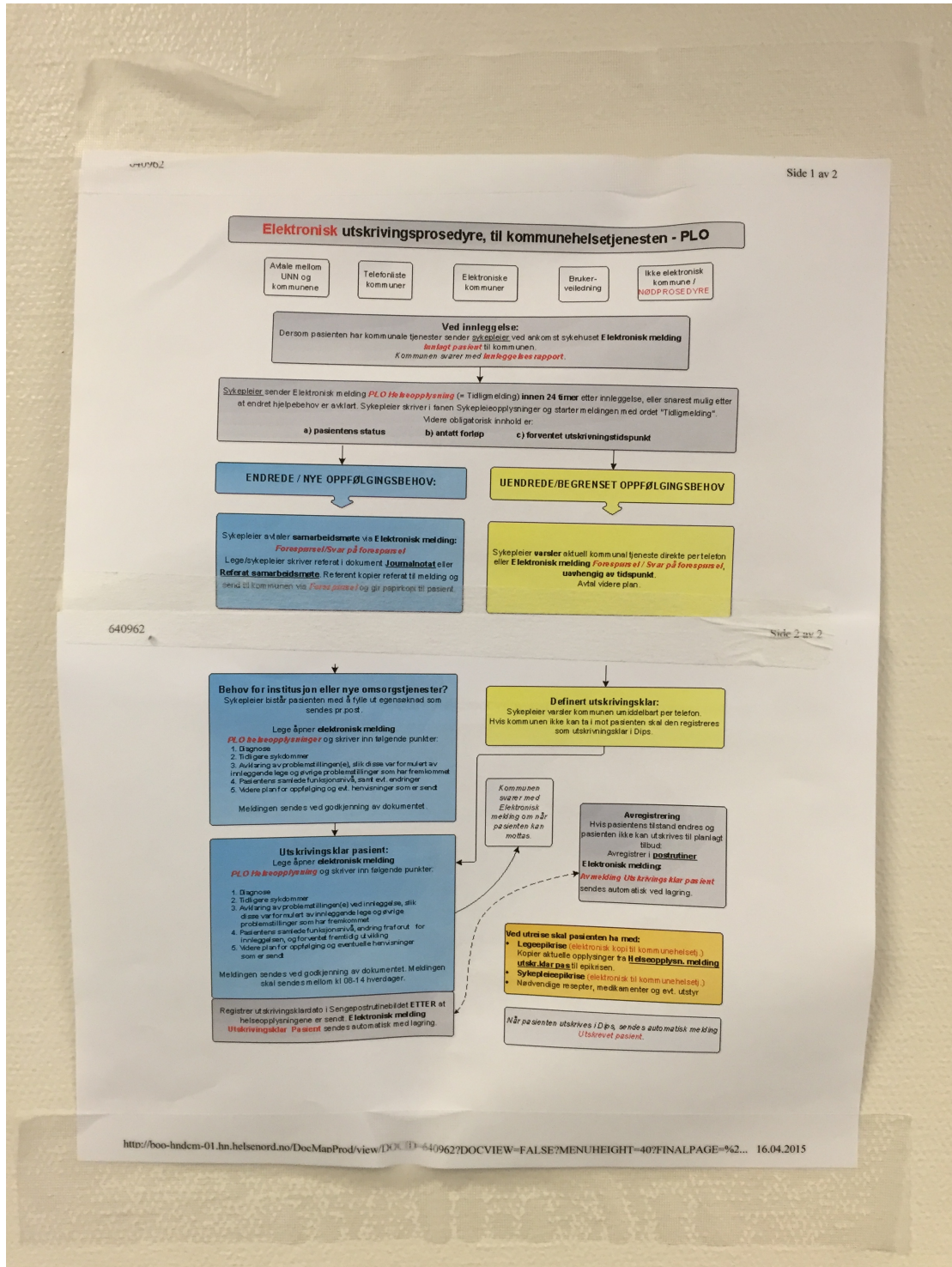
Figure 8: Physical copy of messaging procedures in the hospital.

Hospital users told us that they had to rely on guides and templates when they were unsure about how to use the message system. They had one electronic template located in the hospitals procedure database, as well as physical copies on the walls in the staff offices. When asked about the guides, one nurse from the inpatient surgical

department told us this: *"It is much easier than what it (the guide) illustrates that it is. One becomes a little intimidated by it. I believe that personal or oral training is better that the posters."*

They also expressed that one would rather wait until Monday to send a message, when there were someone they could ask, than try to follow the guides.
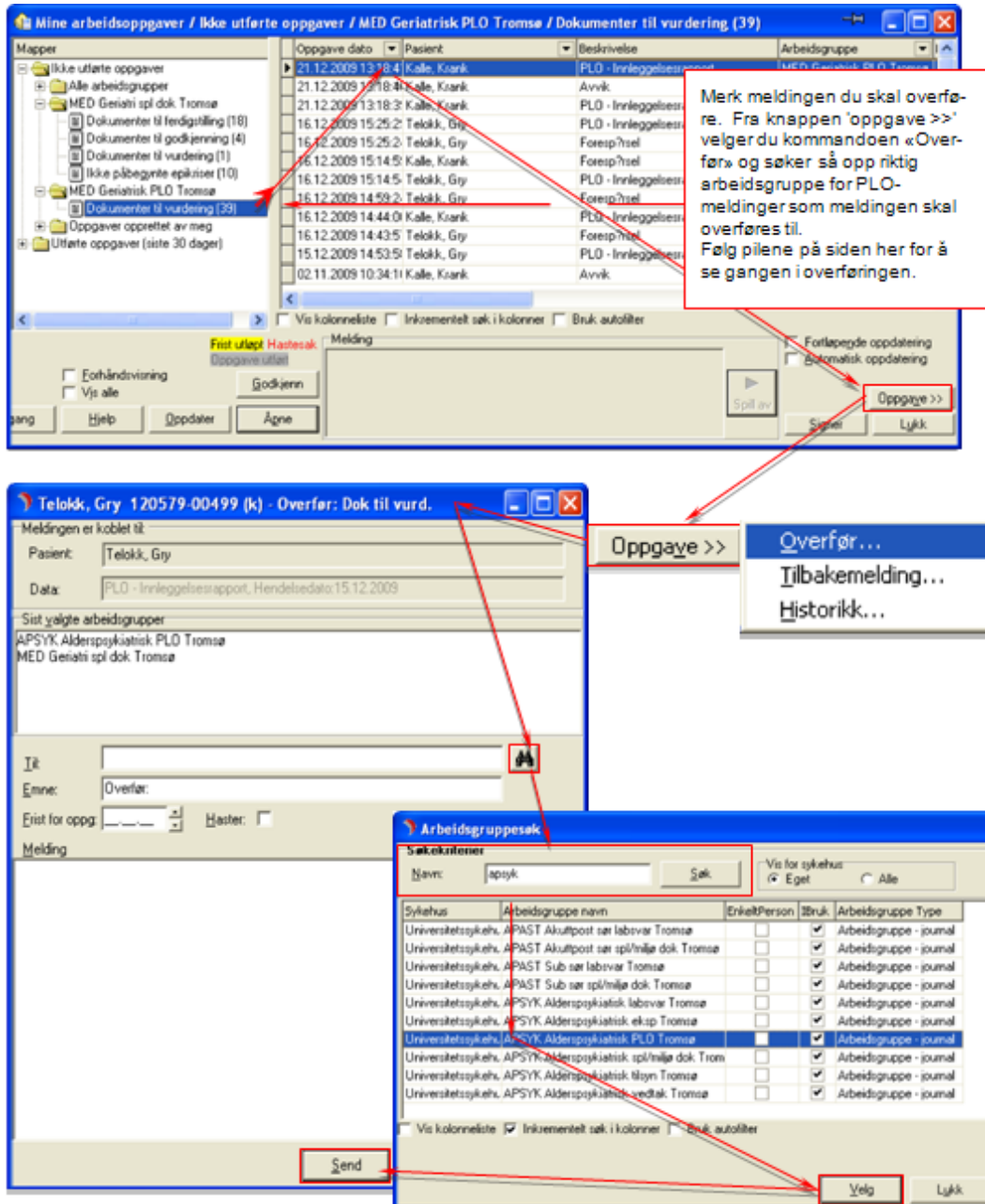
Figure 9: Screenshot from hospital EME-manual

5.1.2 Lack of organized training in the municipality

The education of users in the municipal healthcare service was organized and conducted in a similar fashion as the one in the hospital. One to three users from each department attended training courses were system functionality was demonstrated. The users also performed actions in the system themselves, sending messages between two test databases. The goal was the same as in the hospital; that super users should provide education and training to the rest of the staff at their departments. One of the nurses said this:

> *Yeah, we had that (education) when the message system was introduced. We had some organized training. Besides that we usually have it when we get new staff or people have been away for a long time and feel insecure, then it's more like one-to-one training. Or when someone is sending a message, they have someone sitting besides them watching.*

This illustrates the intended process of education, where super users function as a resource in within the department. Other homecare nurses did, however, have different experiences with education: *"No, I don't feel like there has been any structured training… We don't have any experts on it, maybe we should have had."*

We found differences in how users were trained between the municipal departments, and users had also found their own solution to an experienced lack of organized training. Often they said that they would seek out nurses they knew sent a lot of messages, and ask them, or they would call the municipal IT-personnel.

5.2 Connecting system features and work practices

5.2.1 Message notification leads to increased system use in the municipality

When asked about messaging routines and follow-up of received messages, most municipal nurses stated that they had well-established routines, at least for communication with the GP. An important factor for this was how the system notified users of new messages every time they logged in to the EPR. A small, yellow triangle at the side of the screen would flash when a new message had arrived in the inbox.
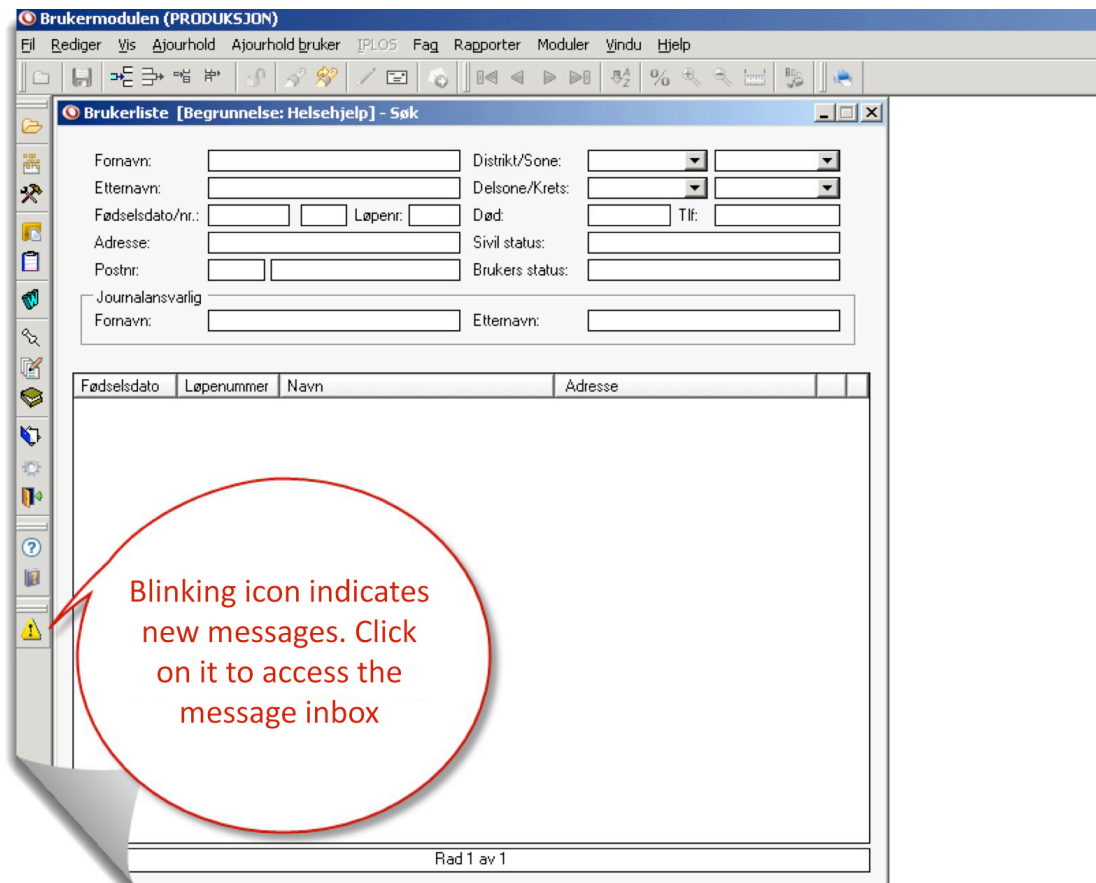
Figure 10: Screenshot of municipal guidelines that show the notification icon

Our municipal informants stated that this function "forced" them to check the inbox to "get rid of" the notification. When asked about usage of the system and checking for new messages, a municipal nurse, who had periodically functioned as the department leader, stated:

> *I think all nurses have proper routines… We check them (messages) in the morning and we check them again when we come in to lunch. If we are to write something in the report and already are logged into the EPR, you can just press the button to check if you have new messages. And in that we use it so actively for sending messages, you are always interested in checking if there has arrived an answer on the message you or your colleague have sent.*

When explaining their messaging routines to us, the flashing button was often brought up, and a point made of the fact that it was the only button you had to push to enter the message inbox. Once they were logged in to the EPR, the inbox was so readily available that it felt natural to check it. When asked about how many times they checked their inbox, one experienced municipal nurse stated:

It varies a lot, but you know, the first thing we do in the morning is to log into the EPR, and check to see if new messages has arrived. Then we can also check the patient reports in relation to the night or the evening before. And I check the flashing notification button at least four times a day. So every time I'm logged on the EPR I check, and if there are new messages I consider: "is this anything I can process? Is this something I should do right away? Is this something maybe the patient's primary-contact should do, so I should tell her that a new message has arrived?"

Because municipal nurses used the system on a day-to-day basis to communicate with GPs, they frequently had to check for replies. Municipal nurses usually had EPR-access for patients in other, nearby departments, and the notification button would also flash when new messages regarding these patients arrived in the inbox. The only way to know if the new message was relevant for them or the other department was to check the inbox. When asked about departmental routines regarding processing of messages, a nurse from the residential home care told us:

Yes, I think it is easy due to the constant flashing in the top corner. Once one enters the EPR, it almost always flashes because we've access to (patients in) all departments. So although not I, or our department have received a message, another one might have, and then it flashes on our screen to.

Another municipal nurse shared the same opinion:

It says to check messages on the work list, and the responsible nurse always have the responsibility to check the inbox, and it is always blinking, the notification button. So each time you log into the EPR, you will naturally check it. I check it everyday.

5.2.2 Lack of message notification complicates system use in the hospital

In the hospital on the other hand, several of our informants specifically mentioned that they missed a notification feature, and that the lack of it probably reduced the frequency of checking the inbox. Some informants drew similarities between notification systems for e-mails on smartphones. One nurse from the medical inpatient department said:

If you have a lot of things to do, the messages can easily disappear from mind. So I wish there was some kind of notification button, or a red colour, or something that told you that your message was replied to. We get so many messages. I think it leads to some of the messages being answered later then they need to, than if there was a notification when you activated your patient, like a notification, something that told you "you've got mail!". There is a reason why you get it on your phone, you know. That is a feature I miss, which allows us to see clearly that there are communication going on, and messages that need to be read.

As stated in the quote above, the lack of such a notification could lead to the messages residing in the system for longer than necessary. This is especially important when it comes to the messages "Request" and "Answer to Request", which goes back and forth between the hospital and the municipality. These are often used to plan meetings and other practicalities, and it is easy to imagine how it can cause delays when these messages are not checked regularly. A nurse at the surgical department exemplified this:

I miss a pop-up function which tells you "a new message for you has arrived". Everybody does not consider that you must log on to the EPR to check if the message has reached its recipient, or if we have gotten an answer. It would have been nice to be notified in some way. It has happened that some messages has resided in the inbox for several days without people processing or answering it.

5.2.3 Message standards unsuitable for work-practices

In addition to the message notification feature, another issue our informants brought up was the structure of certain messages. At the hospital, users stated that some of the professional messages had a lot of information boxes and check-off boxes, and that there was some uncertainty connected to what the message actually was to contain. There seemed to be different routines on what to include, and several users stated that they excluded to write in several boxes, and focused on writing all relevant information in one box.

Municipal users often mentioned that the predefined message structure in some cases could hamper the exchange of relevant information, and emphasised the benefits of writing information in free-text. There were a number of subcategories offered when sending a message from the homecare service to the GP, but nurses only applied a

few. This was despite some categories being more suited for the content of the message. A nurse from a homecare department stated:

> *We got notified that we should use only the message "Request" even when what you want is drug information or a prescription, because the other message categories includes much more information. In the request message, only the message is sent, but in the others, much more information followed... So we only use one of them (message categories), even if I want a prescription or have a medical question, or other things…*

A nurse from the residential care home told us how they and the GP had negotiated and agreed upon a communication standard that suited their work in a better way. She said:

> *There are a lot of choices. And the GPs notified us, through the administrative personnel in the allocation office, that we never should use the category "Medical information" when sending a message to the GP, because all information about the patient will be sent along. Information about medication, diagnosis and a whole dissertation is sent. In addition to the text we have written in free-text somewhere. I consistently use "Request" as the message type, because that message only sends exactly what I've written, and the name of the patient…*

5.2.4 Message standards causing potential sources for error

Another feature often mentioned was an electronic medicine list in the EPR that was automatically included in the Admission report, and had to be checked off if it was to be excluded. In the later years, there has been initiatives focusing on employing electronic medicine lists, but they had failed due to the complicated nature of managing the system, and ended with most homecare departments terminating the initiative. One municipal nurse stated:

> *Yes, they (patients medicine lists) are supposed to be filled in and updated in our EPR, but they change so rapidly for our patients that we have abandoned updating it in the EPR all the time. There are changes in medication almost daily, and we don't have the capacity to follow it up. So when a patient is admitted, we send in the medicine list from the (paper) cardex, which is always updated.*

The failed initiative caused outdated medicine lists to remain in the system, which in turn was automatically included in the message "Admission report", if not manually excluded.

Figure 11: User interface when sending an Admission report. Notice the number of tabs at the top of the screen

An experienced municipal nurse who periodically had functioned as head of department in one of the homecare departments pointed out how this could cause trouble:

> *When we answer the message Admitted patient with the Admission report, there are a lot of tabs you can look through on the top of the document. If one is not aware that the medicine list registered in the EPR is not updated, and you send it along with the message, you actually send along the wrong medicine list, and that is a big source of error! I think that's quite scary. And I don't think everybody is aware that you have to check it of if you want to exclude it from the message.*

Figure 12: User interface of the pharmaceutical-tab of the Admission report

Another issue related to message structure and medicine lists, are the amount of systems in use for drug handling, which can potentially further complicate the transfer of drug information across health levels. For the current system to function safely, all actors, both at UNN and the municipality must be aware of how the other one handles patient's drug information. This becomes clear in a statement from a municipal nurse:

> *You see, we don't have only one system; each GP have their own, we have our own, the hospital has their own, and the pharmacies has theirs, then we have a total of four different systems which doesn't communicate. I truly believe sending the medication lists along with the Admission report could have made our work easier if it had been updated regularly; it's an important feature. The challenge emerges when I know that not all medication lists are updated, and if it then gets sent along, I would question if it were updated or not. We had a patient that got admitted during a weekend, where I called the hospital the next day to ask if they had an updated medication list. They told me yes, but actually they had one from May, while this happened in August. And then I had to fax the correct list to her. And I start to wonder; what if I hadn't called them? Would they have followed the medication list from May? A patient's situation could have changed a lot during that period of time… It is potentially a huge source of error.*

Hospital users stated that the Admission report would be especially useful due to the medicine list, if received early enough. However, because it varies whether municipal departments use the EPR medicine lists or not, they can only be truly trusted if you

know that the sender are regularly updating them. The hospital nurses did not seem to consider this, and none of them expressed any knowledge about whether or not municipalities kept the medicine lists updated. On the contrary, they were often emphasized as one of the most important features of the Admission report. It is easy to imagine that it would be impossible for each hospital nurse to know what municipal departments who are actually using the EPR medicine lists, and if it is correct. One hospital nurse stated:

> *The Admission report should have been with us before the patient comes to our department. Sadly, it often arrives a while after. They often send the message the day after admission if a patient is admitted during the afternoon. Then you often have to use the phone to obtain information. Otherwise, it is quite useful, as it contains the medicines and previous medical history, that's nice.*

A second nurse also mentioned how the medicine list from the municipalities' Admission report could make their work easier. But what also emerged from the interview was the amount of work demanded to obtain the correct list if they noticed there was something wrong with the one from the Admission report. An experienced nurse from the medical inpatient department tried to explain the routine of obtaining the correct medicine list:

> *… Then you have to call them to get in touch, and they are out in the patients' homes working, so then they have to call you back… So yeah, it takes time. If we had been automatically alerted in the system, or the medication list had automatically been imported to our system, it would have been done in five minutes. And then, if there is something that doesn't add up, you have to pick up the phone and call them. And then they can tell us that "yes, but we sent it in paper with the patient". And the case with paper is that there is no control on who has it. The doctor may sit on it for a while. In addition, we see that often, also the paper medication lists are of an older date. They may be stressed and such. And also, the medicine list on the back of their pillbox might not either be correct. So we cant trust that either… We need a proper and updated medicine list.*

5.2.5 Message standards as a source of confusion

Another issue was that data from a national health scoring system, called IPLOS, was automatically sent along with the Admission report if it was not checked off. IPLOS is a scoring system that describes municipal patients' assistance needs in several

different categories, like nutrition and hygiene, and you score the patient with the numbers 1-4 relating to how much help they need. A municipal nurse exemplified the issues with the message structure and the automatically added information by saying:

> *It harder to send the Admission reports to the hospitals. I struggle with them. It is not pedagogical or logical in how you should do it. It is hard to paste a document written in the patient's journal into the message. I don't know how to do it. I think I need more training; it ends up with writing the message in free text. It is also a weakness that we can't keep the IPLOS updated. It is registered within the EPR, but we can't keep it updated.*

Municipal nurses stated that there were problems with the IPLOS register as it was not properly updated in the EPR, and thus added little value to the Admission report. The nurses in the hospital told us that the IPLOS score had close to no direct value at all as it was a scoring system they had limited knowledge about. Another issue they pointed out was that the IPLOS registration was probably conducted when the patient was in his or hers habitual state, and was thus not perceived as relevant as patients gets admitted due to a change or worsening of their habitual state. One hospital nurse said:

> *Our challenge is that we have the patients when they are in an acute phase of their disease. What we can use it for (IPLOS), is to know what we can reach towards, but we have to relate to the patient and the situation he is in right now. And his habitual state can be reduced, he can be dehydrated, and have heart failure. And when we then look at the numbers and talk to the homecare service its not concurring either, because the patient has been deteriorating for the last 14 days, and they have increased the help they give the patient, because the patient's situation has changed. But they haven't changed it (IPLOS), because they don't know if this is permanent or just for a short period of time. So, OK, it is something we can reach for, but we have to use our own eyes and head. But it has some function, as we know how much help the patient needed before… So we can push them a bit.*

The same nurse also stated that there was rarely other nursing related information embedded in the messages, and that they had to ask the homecare service specifically for such information:

> *No, it varies a lot, but I can't say I have seen much of it (nursing related information). That's more if we specifically request it or something, where we write that the patient has been admitted, how much help does he need? But there is no nurse summary from them, no it's not.*

The IPLOS numbers was therefore sometimes experienced as the main bulk of information in an Admission report, in despite of providing low value for the hospital nurses. From our interviews, this seemed as a multifaceted issue. First of all, the municipalities had trouble keeping it updated, secondly, patients were often in a different state than when they were scored, thirdly, the hospital users has little knowledge about the scoring system as they didn't use it in their day to day work. However, compared to the medicine lists, this feature was not regarded as a potential source of error, but users stated that irrelevant information increased confusion when they used the system. When asked about the IPLOS-score in the Admission report, a hospital nurse who was also a NUC super user, stated:

> **Nurse**: *Yes, its only these numbers, you know, you have these categories, like personal hygiene, mobility and such. And then it's ranged in relation to how well they do in the different categories. And that took a long while for us to understand, is 4 best, or is 1 best? And we kind of had to look at the patient to understand the numbers. So it took a while before we understood what they were reporting to us. But that is the information in the answer from the municipality (Admission report).*
> **Interviewer**: *Do you get any useful information from the IPLOS score?*
> **Nurse**: *No. To be honest, I quite rarely look at that (IPLOS score). I don't do it. I am aware that we get the answer from the municipality, and its opened and such, but I don't look at the scoring. Not me anyway.*

A nurse from the municipal homecare service stated that there was not enough information in the EPR, or that it was not sufficiently updated, for the Admission report to fulfil its function as a source of timely information for the hospital users: *"The information which is to be automatically embedded in such a message is not in our EPR in the first place…The medicine list and other things aren't updated…"*

Because of the way some messages automatically included information from the municipal EPR, users felt that poorly updated information could affect the quality of the information sent. In other words, the original intention of supporting hospital staff with updated medical information about the patient was not fulfilled. It also entailed that municipal nurses had to use two or three different communication methods to convey the information that in principle could be conveyed over only the EME system. This situation seems to be partly caused by the message structure and how it

automatically includes information from the EPR, and partly because nurses in the homecare service seem to lack proper routines for updating the information in the EPR. A municipal nurse stated:

> *The information we send to the hospital when a patient is admitted (Admission report), that's actually quite thin, it doesn't say much. When we can't send along the outdated information, there is not much information left in the message. And we have to send along the medication list… Our routine is that we send it with the patient (in paper) when they are admitted.*

In the hospital, nurses also stated that there was uncertainty associated with the addressing of messages. As mentioned in the Background chapter, there is only one address for the whole municipality of Tromsø. This confused and made nurses uncertain in relation to whom the recipients of the messages were. The system standards did not fit with reality, which made it harder to understand. A nurse at the surgical department, who also had experience from a municipal homecare service, stated:

> *I'm not sure that the homecare service gets to read everything we write in the electronic messages, it's hard to answer why its like that. I feel that when we send a message, we always send it to "Tromsø PLO Rehab" or something, and under there I can choose another service, like a nursing home, and then I think, the patient is going there, so I press the button. And then a guy called me yesterday and told me "no, all messages are to be sent to Tromsø PLO Rehab", and then I don't understand why we get other choices. That makes me insecure.*

5.3 Organization of clinical work and system use

5.3.1 High turnover in specialized care negatively affected system use

Informants from UNN often mentioned high staff turnover and job rotation as a serious impediment to effective use of electronic messages. If one nurse had sent a message, another nurse often had to complete the messaging routine with the municipality, which left some form of uncertainty in the process. Several of our respondents felt like they lost some of the message-related continuation due to this. This reduced the perceived benefit of using the system, like one nurse from the surgical department put it:

> *Also, I think that since we are so many nurses who care for one patient, like he may even have a new nurse every day, the follow-up is not so good. If I start a message dialog with the municipality, the next nurse may not be aware of it and don't follow up the dialog I initiated. If you have responsibility for the same patient for a whole week, then I can see the benefit of it (dialog messages). But with the high turnover I don't believe that the follow-up is good enough.*

They felt like the high turnover and intensive job rotation prohibited them in achieving continuity in the follow-up of patients. The fact that there were several different nurses involved in the message exchange also led to some concern regarding the content quality of the messages. One experienced hospital nurse from the inpatient medical department expressed that the content might be more coherent if you had one person tasked with electronic message exchange:

> *I am sure we can get faster to send and respond to messages, and better to include the right information in regards to what the municipal nurses need. But then again, we are 50 different people that have to relate to, and deal with, the electronic messages. If you had one person assigned to message exchange, he might be able to learn what information they actually want. As it is now you have to just figure it out along the way, and we all have different ways to do it. Some of the nurses have been here for 14 days, other have been here for 16 years, like me. So yeah, the messages will be different.*

The intensive job rotation and number of new hires seemed to be the major concern for most of our respondents in regards to both message content and the ability to follow-up initiated message routines. This also made it more difficult in regard to training, as a second nurse from the medical department stated: *"Since we have a high turnover there are always people who don't have training or education in the use of the message system. There are always someone new in the department"*.

The inpatient medical department had specific group leader weeks for nurses. When a nurse had the group leader function, they were responsible for all discharges and electronic messages for all of the patients belonging to that group. This is in contrast to the situation at the surgical department, where individual nurses were responsible for their own patient's message exchange. The role as group leader would typically be assigned to the more experienced nurses, resulting in that the less experienced would get fewer chances to familiarize with the system. But even with the message

responsibilities assigned to one person, the nurses experienced challenges in dealing with the messages. One of the nurses at the medical department said this: *"Often it requires a bit more to get it to work in practice. We are many different people with different backgrounds, and there are few concrete indications to what it (the message) should contain."*

Even though fewer nurses had responsibilities for handling the messages than the surgical department did, they felt like the message content and handling was based on individual preferences and not central principles.

5.3.2 Continuity in municipal care positively affected system use

In the municipality homecare, the nurse staffs are smaller, and they only have a two-shift rotation. Even though the rest of the caring staff and other professions can read and observe messages, it is only the nurses that can send and handle the message exchange process. They stated that this was important to achieve continuity in messaging routines, and it allowed specific nurses to follow up on messages they had sent. They strived to ensure that as few people as possible was engaged in each message process. One of the municipal nurses said this: *"We try to plan ahead, if someone know that they wont be at work the following day, they will leave a note saying "Please follow up on this". But we try to make sure that not so many people get involved in each message dialog."*

The nurses in the municipality had a lower degree of turnover, and did not have the same level of new hires at the same time compared to the hospital. This contributed to making it easier for each nurse to follow up on the messages that they had initiated themselves. This is in contrast to what the hospital nurses experienced. As a nurse at the inpatient surgical department said when asked about what made follow-ups difficult:

> *One reason is that there are a lot of different people who have responsibility for the same patient, and almost no one has responsibility for the same patient two days in a row. We work afternoon shifts, night shifts and day shift. Usually it is during the day that the most coordination, discharges and communication with the municipality happens. Even though we strive to*

89

assign a primary nurse to the patients in order to keep track of things, it often happens that some one else has to take over the responsibilities. Not all of the nurses check the messages, so they don't know what messages that has been exchanged.

The municipal nurses also seemed to have a good routine for updating each other on current message processes. If the nurse responsible for a message dialog were going on holiday, she would leave a written message in the wards' schedule book. This would be read on the morning meeting the next day and followed up by another nurse.

5.4 Intended and unintended consequences affecting routines

5.4.1 Unintended consequences creating new work tasks in the hospital

Hospital users frequently described use of the EME system and associated communication procedures as imposed tasks. They described that the incentive for using the system was mostly economic and driven by their leaders, and that they experienced limited direct value from the system. Several nurses also informed us that there had been trouble getting everybody to follow messaging routines. This stands in contrast to the municipality, where nurses emphasized immediate benefits as efficiency, quality of information and more formalized communication as motivational factors. A hospital nurse at the inpatient surgical department stated:

We are supposed to send this at once when they are admitted. But if they are admitted on a Saturday for example, it's often not done until Monday. And then its often they (leaders) who reminds us to send the NUC-messages. They don't exactly nag, but their very watchful. They remind us quite often.

Another opinion shared by the hospital nurses was that "electronic things", i.e. new IS and routines, often could hamper workflows and make work take longer time. The EME system introduced work tasks they did not have before, and these new routines were experienced as additional work for the nurses. When the system failed to provide users with any direct benefits, it reduced their motivation to use the system. Another hospital nurse stated:

That's the thing about electronic things, it often stops somewhere. Unfortunately, often with the doctors. Like with the nutritional screening (another recent hospital project), it's we (the nurses) who have to do it in the

end, because they never do it, so it becomes our responsibility. In the end, we have to do everything to make everything work smoothly.

However, hospital nurses also stated that the system probably had advantages related to the administrative aspects of discharge, and that it possibly made admission and discharge of patients more formalized. A nurse at the inpatient medical department stated:

> *Its safer, more quality control, when you send the message. The municipality know the patient is admitted. You can see in the EPR that the message is sent, while if I made a phone call, I could have forgotten to write it in the report, and someone else might have called, and it would just be a duplication of work. So in that way, qualitatively, it's a better system. All over, I think it's an OK system. In the start I was frustrated, but it gets better.*

Despite seeing the potential benefits of formalizing some communication, hospital users experienced little direct value in the system. They exemplified this by describing how they had to call the municipal homecare services despite using the electronic messaging system: *"It does not help to send an electronic message when the recipient cannot open it. After you send it you wait for an answer, but it never comes. In the end you have to call them (the municipal care service) anyway"*.

One of the new routines associated with the EME system was that doctors' and nurses' summaries were to be sent electronically, as well as in-hand with the patient upon discharge. Several nurses failed to understand why this double-procedure was necessary. A nurse with 16 years of experience from the inpatient medical department stated:

> *We duplicate everything we do. We are sending it electronically in addition to everything we did before. They can say they want us to send it electronically, that's the ideal world and all. When we have tried it, we get a phone call later that afternoon from the homecare asking us where the summaries are. They haven't seen it because they are in the patient's home already. So they ask us to send it with the patient. What happens is that what we send over the EME system becomes less comprehensive, because we send a bucket of papers with the patient anyway.*

This was one of the additional work tasks that led nurses to experience electronic message routines as duplication of work. When the electronic message system failed

to replace the existing routines they did not see the point of sending additional messages, as a second nurse from the inpatient medical department stated: *"The patient is discharged with a copy of the summary in-hand, a copy is also sent to the home care service and the patients' GP. So I think to myself "why do we also send it as an electronic message?" It feels kind of redundant".*

Hospital users rarely described the process of sending the summaries electronically as the problem in this situation; that could be as easy as pushing a few buttons in the EPR. It was rather the experience of redundancy the nurses experienced when using the system that they reflected upon. It did not give them any advantages to send summaries electronically as they had to send them with the patient upon discharge as well. A related issue was how frequently the nurses still had to use the telephone, in addition to the messages. The messaging routines were thus perceived as just another routine they had to comply to. The same nurse as quoted above further stated:

> *And that's another thing we do. We talk to them on the phone. We are supposed to send these messages back and forth, but the last message from the municipality is: call when you send the patient. Before we called them, had one conversation, without 15 messages going back and forth. We had one phone call where we clarified everything, and then we were done. I think we do exactly what we have always done, but now we also have to write the NUC messages.*

Several of our respondents expressed that such situations lead to the electronic messages being experienced as another task they were "forced" to do. As they did not feel that it replaced any existing routines, it reduced their personal motivation to comply with new communication routines. Another nurse at the medical hospital department stated: *"I do not care much for it (the electronic message system). I think it is a lot of extra work for us".* A second nurse at the same department shared a similar opinion: *"Generally, I think that the perception of the electronic message exchange system is that it leads to additional work. It is a pity, because it is some sense and reason to the system".*

Statements like these was actually a reoccurring theme; the fact that the hospital users saw potential benefits of the system, but only experienced the additional work brought

with it. As one nurse put it: *"It is a good idea, the intentions are good, but there is a difference between theory and practice. For us nurses it leads to extra work."*

Several of our respondents also stated that it could be challenging to get other professions to complete their part of electronic message exchange routines. In particular it appeared that the physicians represented sort of a bottleneck in the process of notifying the municipality of a discharge-ready patient. In order to complete the ready-for-discharge message, the treating physicians had to fill out a summary before the nurse could send the message. As this hospital nurse explains, this specific task can be challenging: *"I feel like we have to remind them that they have to write it. We can not do it, we are not allowed to."*

Before the physician has done his part, the patient cannot be discharged. Because of the high pressure to get patients discharged, this was a task that had to be done quite often, especially in the inpatient medical department. A nurse from that department said: *"I think it takes a lot of time! You have to chase after the doctor and tell him to fill out the form, if not, nothing happens."*

Even though this lead to more work for the nurses, they expressed understanding for why the physicians were so slow to fill out the necessary parts of the message. It seemed as this extra work only contributed to some of the general frustration regarding the EME system in the hospital. A nurse stated: *"We have experienced that we have to nag on them to get them to do it, because they have thousand of other papers to fill out as well!"*

A different nurse from the inpatient medical department stated that she believed that the physicians had more challenges with the electronic message routines than the nurses. It seemed that low compliance to messaging routines among the physicians also was caused by a lack of immediate benefits from the system. It did not seem to directly replace any routines, and was experienced as duplication of work. She stated:

> *It has been more trouble for the doctors, because they feel like this (the ready-for-discharge message) is a major duplication of work. Like, why do they have to write that (the message) in addition to the discharge summary? Perhaps*

they try it once, and something bad happens, and then they don't bother to do it anymore.

Some hospital nurses also stated that the experienced additional work led them to move further away from the patient than what they wished for. The new EME system and communication routines came in addition to many other more administrative initiatives as a nutritional screening project and new pharmaceutical routines. One nurse stated that she did not understand why the purely administrative information was to be sent and handled by nurses in the hospital, as the municipality had dedicated people to do this work. A nurse from the surgical department stated this when asked about the system:

> *I find that the computer takes away a lot of time that I much rather would have spent with patients. I think that we over-document. It's supposed to be documented on this sheet, in the treatment plan, in the messages, and so on… It's the same stuff all over, and I think we use incredibly long time on it, time we really should be using with the patient.*

A last aspect that some informants pointed out was the increased amount of planning now needed to get a patient home. Meeting planning was done over the electronic messaging system, and as administrative personnel at the allocation office only were at work during daytime, which could lead patient discharge to take one extra day.

5.4.2 Improving workflow and replacing routines in the municipality

The municipal nurses we interviewed stated that they used the electronic message system for information exchange with both GPs and the hospital. It was, however, clear that the majority of information exchange was between the municipal nurses and GP. A municipal respondent said: *"I only use the system to communicate with the GP. Or, we do get a notification of admitted patients from the hospital, and we then respond with an Admission report, but besides that all communication with the hospital is done over the telephone".*

Another nurse also expressed that their relationship with the GP had gained the most from the electronic message system: *"I believe that it first and foremost is the cooperation with the GPs that have benefited from the electronic message system."*

They were motivated to use the system for communication, as they saw the immediate advantages the system provided, both for them and for the GP. They had even experienced more involvement from the GPs side, as they now sometimes got requests regarding how the patient was doing. A municipal nurse explained how the EME system made the communication with the GP more direct as health secretaries were eliminated from the process:

> *I think it's a positive thing. It much easier to write an NUC-message, and when you get an answer, everything is much more effective. It easier to get in touch with the GPs, and communicate directly with the GP in stead of first calling the secretary and then get them to check if the doctors have time to talk, and maybe they don't, and they have to call me back, and I might be busy. No, I think its (EME) is very positive.*

Another municipal nurse stated:

> *To be on the phone (with GPs) takes so much time! And normally you don't even get to talk to them, or the secretaries tells them to call us back, and they are busy you know, and maybe they don't call back until we are going home from work, and then we cant do much. And if they need antibiotics, if they have symptoms of a urinal infection, they sometimes don't call us back. Also, in relation to warfarin (anticoagulation) treatment, where we can send the test result and get the new dosage in the inbox, instead of the phone. That's very timesaving.*

These experienced benefits were supported by the GP, who also emphasized how he saved time in his daily work by using the messages. He specially mentioned improved quality in pharmaceutical routines, more convenient follow-up of patients, and the way the system allowed for direct contact with municipal nurses. He stated:

> *When you can send a message, and get an answer in return, you avoid using the phone. I think the NUC-messages, and the way they support communication with municipal nurses, is very, very beneficial. And I experience that the municipal nurses are also very satisfied.*

Another positive aspect for municipal nurses was that they now could write out whole stories about the patient to the GP, explaining problems thoroughly. When this was done over the telephone, they experienced that the doctor didn't have time because he

had a patient or other things to do. As an experienced nurse from the homecare stated, this lead to improved quality and efficiency in the communication flow:

Now, I can write the whole case, our worries and observations. And the GP has to read it, and answer it. Or he can call us after he's read it, but then he's got time you know, so he can actually talk. So it's an easier, more effective communication flow. And its easier to update the GPs on patients situations, I don't feel like I'm bothering them. And I feel its important to keep them up to date, so I like to send them "update reports" and make them consider the patients situation... I feel I get more flow in my workday, I get to give more information to the doctor, it increases cooperation, we can make an A and a B plan and everything gets documented, not only on the phone you know.

The increased quality of information, and patient safety was also an aspect the GP brought up as a prominent and important feature of the EME system. He said: *"I believe it increases patient safety, it actually provides quite high patient safety. That's one of the things this system brings forth. Things don't disappear and gets lost just because you loose a document, or miss a call, or something"*.

A nurse from a homecare department, who had worked in homecare for over 20 years, also said something about how rapidly they became dependent on the messages. When one of the GP offices was lagging behind on the implementation, they could see how much more effective the messaging system actually was:

...We were so frustrated that we had to do everything over the phone. And the GPs phone-hours didn't fit with our work-routines, and when we finally came through after waiting a long, long, long, long time, maybe the GPs reception was closed for the day, and then I wasn't coming into work for maybe next week. You know, things have a tendency to get forgotten. And when you have to give an important message to someone else, either its not done, or its perceived in a different way then how it was intended. So there is a lot of potential errors, but now I know I can send it to the GP when its fresh, so it's a good system.

Nurses in the municipal home care seemed overall pleased with the system, mainly due to the improvements in communication with the GPs. They experienced direct benefits from the system as it replaced more time-consuming communication routines, and it was perceived as a good alternative for asynchronous communication.

As one home care nurse explains, the GP is their main communication partner and a significant part of daily work revolves around contacting and consulting the GPs:

> *I think that the electronic message exchange system is one of the best things that have happened! Now we communicate much more with the GPs, but we spend less time on it. Previously we spent all morning on the phone trying to get a hold of the GP. Maybe the GP had a patient consultation, and your conversation only turned out so-so. Now you can ask in an accurate way, and get an accurate answer, in writing! It will also be documented in the patient's electronic journal.*

Respondents said that their contact with the GPs mostly consists of non-acute information exchange, and they are thus not dependant on immediate responses. Patients often rely on long-term services, which make their situation well known both for both parties. Patient's situation thus facilitated a way of working that suited the EME system, and seemed to be an important factor for the satisfaction and usability of the message system. Several municipal nurses, as well as the GP, referred to the process of dosing anticoagulants. A nurse from one of the homecare departments stated:

> *Often you have many patients with INR-measurements, in other words to dose warfarine (anticoagulation). Now you can just send in the results, and get the correct dosage sent to your inbox, instead of sitting by the telephone. I think it is timesaving in my everyday work.*

Users also stated that an advantage of the electronic messages was they way they formalized communication with the GPs, and that they could be sure that all information they needed to convey reached the recipient. They could also send their requests on more appropriate times, and did not risk being in a patient situation when they received phone calls from the GP. The fact that the nurses were able to communicate when it suited them was a recurring theme in several of the interviews. A nurse from the residential care home told us:

> *It (the electronic message exchange system) makes our everyday life easier. I can send a message when it suits me. I can do it on a Thursday afternoon, on a Saturday morning, or a Sunday night, and I don't have to wait in a telephone queue in order to get in touch with the other person.*

5.5 Collaboration routines between the municipality and the hospital

5.5.1 Unreliability in electronic communication for municipal users

Most nurses in both the municipality and the hospital were positive towards the concept of electronic messaging as they saw how it potentially could lead to a more convenient workday and safer communication procedures. Despite of this, they described a lack of compliance to message routines. Several of our informants stated that not all messages was sent when they were supposed to, that receivers did not know how to process messages, that information in the messages were not always relevant for the current situation, and that routines and documents often were duplicated (e.g. telephone and messages, paper and electronic).

One example of this was that doctors' and nurses' summaries were to be sent both electronically and physically with the patient upon discharge. However, several municipal nurses experienced they were most often only sent in physical format along with the patient. One of them stated:

> *Nurse: Either we get the summaries over the electronic system, or they send it along with the patient. But we normally get a notification of discharged patient and that they are sent home. Its not always that we get the summaries electronically, but then they send it along with the patient.*
> *Interviewer: Do you prefer getting it electronically or physically?*
> *Nurse: When they come from the hospital, I prefer getting it electronically, because we get it faster. When they are sent along with the patient, we have to physically pick it up from the patient. And if there are changes in medication, its good to have that prepared beforehand, and know what we are to help the patient with.*
> *Interviewer: What's the most common way of receiving the summaries?*
> *Nurse: That's paper, we most often get it in paper.*

Nurses in the municipality stated that because they could not trust the messages to arrive, they were not more prepared when they were to receive patients arriving from a hospital stay. One municipal nurse said:

> *...the messages normally arrive after the patient is home. So I don't believe the electronic messages have contributed to us being better prepared when a patient is discharged. Had they come before the patient came home, then maybe. The nursing summary normally comes by paper, along with the patient... The ones the doctors have written come electronically. But if the patient for example has gotten a stoma, then we have to start several days*

98

ahead to get all the equipment we need and so on. So no, I don't think it leads to us being more prepared.

There were several examples of severely ill patients arriving at home, where the nurses had no notice of what services they were to provide. Due to this lack of proper information, they had to use the telephone to obtain the relevant information. A municipal nurse stated:

> *We have experienced getting doctors summaries that are very deficient. Where we were left as a big question mark in relating to "what do we to with this patient", and then you have to take that phone call which is basically unnecessary, because if the summary had been properly filled out, it wouldn't have been a problem.*

The fact that municipal nurses had to relate to several different communication procedures when a patient is discharged stands in direct contrast to the systems intention. Another experienced nurse had a more concrete example of how the lack of compliance to the routines affected both the organization of work and the direct care for the patient. She stated:

> *Sometimes we get a message that tells us that the patient has been discharged alive (automatically generated message), and the patient is already home. Sometimes they call to tell us that he is home. Other times we just get the message "patient discharged", and no summaries, nothing. A patient came home from the hospital the day before yesterday, which we originally only were to visit shortly, to check up on him. The patient himself called us during the evening and was in so much pain that he couldn't even talk in the phone. So we had to Google his number, found out who it was and went to visit him. He had recently gotten a stoma, a catheter through the abdominal wall into the bladder and had cancer all over! He was really sick, and hadn't gotten with him a nursing summary, a doctor's summary or nothing! It had been such chaos at the hospital. The only message we had gotten was that we were to visit him shortly the next day.*

As in the hospital, municipal nurses also felt that the system had potential to support communication between them and the hospital, when routines were followed. The issue seemed to be that the lack of compliance to the routines made the system unreliable. An experienced nurse from the homecare service, who was an EPR super user and had special administrative responsibilities stated:

> *It's very nice when we get the summaries and such electronically. But it seems there are no routines regarding it, there are no consistency in how we get the documents, if they come electronically or not. But it's great when it comes electronically. Often the patient is discharged without the summary, only with a nurse summary, and then its nice to get the summary afterwards.*

Due to the lack of coherent routines, the same nurse stated that it did not contribute to the homecare service being better prepared when patients arrived from the hospital, as it could not be relied on. The messages seemed to arrive at random, and this frustrated her:

> *No I wouldn't say that we are better prepared. That still depends on the communication with, or from the hospital (by phone). Sometimes we get summaries and messages during the hospital stay with updates and so on, in relation to what has been done. But it is not systematized. It is not a system that can be relied on. If you don't get the messages from the hospital, you have no information. No, I don't think it makes us better prepared when a patient is discharged… I think it has potential, but it requires more information in the electronic messages. Now there is only information about expected discharge date. It doesn't say anything about what they need help with, or how they are doing.*

This view was shared by several of the nurses. The messages were appreciated as they gave them the possibility to keep track of the patient, and where the patient was in his or hers course of treatment. However, there were problems relating to the content of messages and how often they actually got them. A second nurse from a homecare department said:

> *I like it (the electronic message exchange system), because we get notified when a patient is admitted, and we might get information regarding the hospital stay and the patients situation and further treatment plans. But sometimes I would wish that we got more information from the hospital. We get the message admitted patient, and patient ready for discharge, but sometimes, occasionally we get a message where it says a little more of what has happened while they have been admitted, it doesn't have to be that much, and its very nice when it does, but it happens rarely.*

It seemed to vary if messages was sent or not, and in some cases no messages was sent throughout a whole hospital stay. One municipal nurse reflected that the difference in compliance to the routines was due to variations of patient groups for

different departments at the hospital. Some departments has a preponderance of patients in need of municipal services, while others more rarely needs it. She stated:

> *It is not always we get the messages we are supposed to. Its not always we are notified that a patient is admitted. Sometimes we don't get a single message throughout a whole hospital stay. It has happened, and it's not that long ago. I think it depends on the (hospital) departments as well. Those which are used to having the elderly and patients who often needs homecare services, they are quite drilled in the routines, but they who rarely has patients with the need for homecare services, I think they forget it, or haven't learned it properly. So then we have to start calling to remind them.*

The same nurse reflected that because the system was unreliable, the information exchange had to be complemented with both telephone contact and meetings between the different actors. She felt that several communication routines (telephone, NUC-messages and a meeting) had to be conducted in order to make the communication across health levels safe and robust. Another municipal nurse, who had worked in the municipality for over twenty years, had experienced how the exchange of medical information had changed the recent years, and how re-organization in specialized care contributed to the whole process. She told us:

> *In the beginning, I felt it was good (information exchange), but today, it's not like that. It doesn't work at all. I think it's related to the reorganization within the hospital, and the new structure that presupposes that everything is to happen so quickly. Patients are not to be admitted longer absolutely necessary. We have had cases where patients have been re-admitted after a few hours, and a lack of proper information. It happens often, very often, that we have to call the hospital to get the correct medicine list. The patients often know they have started on some new medication, but can't tell us more than that. Then we have to call them, because the information doesn't appear anywhere else.*

As mentioned above, municipal nurses experienced the system as unsystematic, as there was little consistency in the message flow from the hospital. It seemed random if they got the doctors' or nurses' summaries on paper or through the EME system. In addition, several nurses also mentioned low quality of the content in summaries as a problem. It appeared to be more of the norm than the exception. One nurse stated:

> *No, they (patients) usually get the papers with them when they are discharged. But I feel the summaries are of low quality, they contain little information, no*

treatment plan, nothing about what we are to do when they come home. We want to know if there is anything we should pay attention to, if there is anything we should follow up. Yes, the communication between us and the hospital is bad.

5.5.2 Unreliability in electronic communication for hospital users

A reoccurring theme from our hospital interviews, was that the messages most often was experienced as a media to convey administrative information, and had little to do with the exchange of clinical or nursing related information. A nurse with two and a half years of experience from the inpatient medical department said it could take days before they discovered dementia in their patients: *"In most cases, we don't get any clinical information about the patient from the municipality. I haven't seen that. It's rare. We have had patients admitted for days before we notice they have dementia".*

Most nurses at the hospital had knowledge of the messaging system, but stated that departments struggled getting the routines in place, despite the fact that they had been in use for three years already. When users failed to follow routines correctly, the consequence could be a prolonged hospital stay for the patient. Not starting the message flow early enough could cause ripple effects affecting both nurses' workday and patient follow-up. A nurse at the surgical department stated:

> *We can get better at writing the Early-alert message once the patient is admitted, that's something which is often neglected. Sometimes the patient can leave the hospital in two days, and the message flow hasn't been started yet, and then you have to wait for them to answer. We loose much time while waiting for answers, compared to before, when you could just make a phone call.*

Hospital nurses had also trouble understanding why the routines told them to estimate when the patient was to be discharged within the first 24 hours of the hospital stay. They were forced to set a date, often by guessing. It must be considered that if the information sent does not have a meaning for the nurses who send it, it would be harder for them to experience the system as something meaningful and useful in their workday. One nurse stated:

And that early notification we send, I find that quite messy, as it also says "when do you expect the patient to be ready for discharge?". And that is something we never know within the 24 first hours of a patient hospital stay. So we just have to write that we will come back to it, or that we cant say anything about it now... So I don't really get why it has to be a part of the message. We have to find out what's wrong with the patient before we know when they are to go home!

Some hospital nurses felt that the EME system hampered the patient flow. Routines made patients who could have been discharged stay for an extra day or two because the EME system had to be used. A nurse from the inpatient medical department stated:

The patient flow is slower. We have to have meetings first, and we cant have them before the next day, and if they are not reported discharge-ready before a certain time, they cant come home that day. Homecare services should have the needed staff on duty despite of there being a patient admitted. But they cant come home because we haven't sent the messages in time, or fast enough, or correct enough. I feel it's just a way of postponing some things.

Several of the municipal nurses stated that they normally sent the Admission report when a patient was admitted, however, hospital staff had varied comments on this. Either they had the impression of it containing little other than the IPLOS numbers and pharmaceutical information, or they had not seen it at all. A nurse at the surgical department stated that she had never seen the message, but acknowledged how it could have been useful:

I have never seen such an Admission report, but it would have been useful if the patient had help in his home. If he needs more help, its OK to know what he could do before. They (homecare) know him best. I think we all would have read it if there came a comprehensive report about the patients. Because it happens that we call the homecare to get information.

Other nurses stated that the Admission report was helpful, when they noticed it. Either the nurses did not know where to find the message, or they neglected to look for it as often as they should. Either way it seemed as it often was discovered too late, as one nurse stated: *"It is nice when we find it. It something with where it gets placed. Suddenly you see it when you go to write another message. It's a bit like: "Here is something we got two weeks ago".*

The routine is for the Admission report to be sent within 24 hours after the Early alert has been received in the municipality. The hospital has on their side 24 hours to send out the Early alert after the patient is admitted. This meant that the information in the Admission report often came too late, as nurses usually had applied other methods to obtain relevant information about the patient. One NUC super user at the medical department stated:

> *I don't feel we know that much more about the patient. We have received the patient, talked to him and mapped out the situation together with him and we have read up on the patient. We do all this before we receive the report from the municipality. So it doesn't give us an advantage in relation to the patient.*

The asynchronous feature of the system actually removes the intended advantage of the Admission report. Hospital nurses stated that if it was to be useful, it had to arrive before the patient. Following the current routine, it is still within the allowed timeframe if the message sent from the municipality within 48 hours.

5.5.3 Several municipalities created several communication routines

Hospital nurses expressed some frustration with the fact that it existed different communication routines depending on what municipality you were to contact. They experienced that they had to rely on old routines even with municipalities that had the message system installed. Some of the nurses stated that this was problematic as it implied that they inherently had to know what municipalities that used the system, and what municipalities that struggled. In this matter, the size of communicating municipalities probably has a role to play. Some nurses stated that certain municipalities seemed to rely on only one nurse when it came to electronic communication. When asked about the general opinion of the EME system, a nurse from the surgical inpatient department summarized how several hospital nurses experienced the issue. She stated:

> *We don't even know if some municipalities have the EME-system at all. Smaller municipalities wants to get the early alert by phone, they seem to prefer it, I don't know why. Maybe its not well enough grounded. Often its nice to plan some things over the phone, we let them know when we know when the patient are to be discharged. We also call directly to the homecare service, not only the allocation office, to give them information about the*

patient directly. And often, if there are things you don't want to write down, like special challenges related to behaviour and such, it's more convenient to convey over the phone. But we are using the EME-system more and more. But we had some challenges relating to many new employees, it's challenging to teach them all how to use the system. Things take time.

Several of the nurses explained that different procedures towards different municipalities made it harder to follow the correct routines. The new routines for electronic communication was promoted within the hospital, but could be hard to follow when there were few municipalities to communicate with. The differences made it harder to know which communication methods they were to use, and could lead to unnecessary time spent on waiting for answers:

> *It's cumbersome to communicate with physical documents with the municipalities that can't receive NUC-messages. You have to print it out and write it by hand, and send it in the mail. It takes several days! Then we have to call and send after the needed documents. Its obvious, its not actually an early alert when it arrives three days after you have talked to them over the phone.*

As stated above, the nurses could not trust that communicating municipalities actually would see, open or process the messages. This would lead them to wait for answers, which they might not get. After a few days of waiting, the only alternative was to pick up the telephone and call them. In the municipality of Tromsø, the message from the allocation office often said to call the homecare service directly, especially if the messages contained something other than administrative or practical information. In such cases, the messages did not replace any communication routines, but rather created an extra communication routine that had little practical function for hospital nurses. A NUC super user from the inpatient medical department stated:

> *For example, there is a small municipality close to Tromsø that don't manage to answer us, or they don't know they have the NUC-system, we have had problems with them. And then we have to wait for some days, but when they don't answer, we have to pick up the phone and call them. It also happens that we get a message from the allocation office in the municipality of Tromsø to call the homecare directly. And then we have to call them. That happens quite often.*

When the surrounding municipalities wanted documents in physical format, or failed answer messages sent from the hospital, hospital nurses had no choice but to continue

to use the traditional communication method. Nurses had to choose between forcing the surrounding municipalities to use the EME system, and using the telephone in order to facilitate the discharge process. The work pressure in the hospital did not allow staff to sit around and wait for answers. To benefit from the EME system, they were dependent that communicating municipalities complied with the messaging routines. Another hospital nurse explained what she felt about the communicating electronically with surrounding municipalities:

> *I experience that things takes time. It's OK to communicate electronically with the municipality of Tromsø, but with the surrounding municipalities, it can take a while before you get an answer. To sit and wait for these answers, that are what I feel is extra with these messages. When that happens its better to just pick up the phone and call them, the old way. So in some cases I choose to do it more like we did before, to make it more effective. And then it is this with the doctors; they're more involved now. And it's the fact that we have to teach the new employees how to use the system, it's easier to just use the phone than to fill out everything on the computer.*

The same nurse who stated the quote above, further elaborated on how the different routines with surrounding municipalities could complicate and hamper the training of new employees:

> *I think this is in general quite confusing for new employees. They often come to me for confirmation, maybe they are about to send a message, but they have to get me to check if they are to send the messages or call them. They ask me what I would have done. It's confusing. I've been here a while and seen what works. I try to do it in the way that's most efficient. When you're new its hard to know what's correct or not.*

A different nurse pointed out how it seemed like the size of the municipalities and number of hired nurses could affect compliance to the system:

> *It doesn't work when the ones you are communicating with can't open the messages. You go around waiting, and in the end you have to call to tell them to open the message. And sometimes they say "we cant open the message, the person who can open them aren't here today and wont be in for next week", and then we have to call them anyway...*

In several of the interviews with hospital nurses, it emerged that there was differences when communicating with the municipality of Tromsø, and the smaller, more rural

municipalities. Message use seemed to be more standardized in Tromsø, and they more often got answers. The big advantage for the municipality of Tromsø was of course the centralized allocation office, which might be more difficult for smaller municipalities to organize. Several nurses informed us why they experienced the continuity in the smaller municipalities to be worse, one said:

> *From the municipality of Tromsø we often get a standardized answer, like a confirmation that the message is received, and if there are changes in the patients need for help, we are to send a new message, but if it's the same, we have to call the homecare directly. From the more rural municipalities, we don't get that feedback, and we wonder if they have seen it, or read it. And then we have to use the phone to communicate with them. While in the municipality of Tromsø, it's more automatic.*

As the more rural municipalities had poorer compliance to the messaging routines, the Admission report was often received later than what was preferred. As mentioned in a previous section of this chapter, the medicine list was often brought up as a positive feature of the Admission report. A nurse from the inpatient medical department said:

> *...It can easily go two to three days after the patient is admitted before we get it (Admission report). No later than this last Monday, we had to request it from one municipality. And now that we are to check the medicines with the municipalities when a patient is admitted, it's nice to have as the medicine list is included.*

5.5.4 Message handling hampering exchange of clinical information

Both the homecare nurses and the hospital nurses experienced that most of communication between the hospital and the municipality of Tromsø went trough the allocation office, and not directly between healthcare personnel in the two organizations. This could complicate communication related to information about patient's situation at home as the administrative caseworkers at the allocation office has little direct involvement in the daily care for the patients. They allocate services, but the ones that are working directly with the patient are nurses and other health workers. As mentioned in the background chapter, the fact that all messages was readable to both nurses and administrative personnel made some users uncertain in relation to what messages they were to answer or not. In order to manage the distribution of who were to answer what messages, a document called "message types

and follow-up responsibilities" had been created. This had descriptions of who were responsible for what messages, and contained information about 20 different messages. However, municipal nurses never mentioned this document during the interviews, and one municipal nurse had this to say about message follow-up:

> *People are uncertain if they should answer messages or not. We have often been uncertain if we are to answer, or if the allocation office are to answer. It's been a bit back and forth if they or we are to answer messages. But they have called us and told us that they are to answer some messages, and we are to answer some messages. We haven't had any thorough training relating to that.*

When asked about communication with the hospital regarding admitted patients, municipal nurses stated that most of the electronic communication was conducted between the hospital and the allocation office, and not directly with the nurses in the homecare service. An experienced municipal nurse stated:

> *It's the hospital and the allocation office who communicates the most. I think we are forgotten sometimes. We get a phone call from the allocation office where they tell us: "we have talked to the hospital, the patient is coming home". And some of the information seems to be lost on the way.*

When our informants were asked to map out the communication flow between nurses in the hospital and nurses in the municipality of Tromsø, a reoccurring answer was that practicalities was communicated over the EME system, while the telephone was still the most common communication method for clinical information. A positive aspect was however that several actors had access to the same doctor's summary, as one municipal nurse said:

> *We don't send that much messages with the hospital, we still use the phone, and we kind of have to go see the patient. The messages normally go between the hospital and the allocation office. I think its better when the patients are coming home and the summaries are sent electronically, because both the GPs and we get the summary. Then we know that everybody has the same summary, and it's easier for us to send a message to the GP telling him to update the medicines according to the last summary. When it's sent electronically we are sure that he has also received it.*

Another experienced nurse, who also was an EPR super user, felt that the messages primarily enhanced the efficiency and gave advantages for the administrative allocation office: *"In one way it has probably improved communication (with the hospital), at least formalized the communication more. For the allocation office, especially, its probably a neater way to communicate"*. It was obvious that municipal nurses often experienced the allocation office as an additional step in the communication between the hospital and the homecare service. A nurse who had worked in homecare for over 20 years told us:

> *When an admitted patient are coming home and cared for by the homecare, the hospital only communicates with the allocation office. And the homecare service only gets the information: here is a patient who is expected to come home in a week or two. After all, it is we who are to care for the patient, and we can't have that: "here you have the patient, you have to figure everything out by yourself". We should be included in the process as soon as possible. That would in turn benefit both the patient and us.*

Even if municipal nurses stated that they had limited direct contact with personnel at the hospital over the EME system, and that the majority of communication was with the allocation office, they still had access to all the messages, and could thus monitor the correspondence. However, as described earlier in this section, there was some confusion among the nurses related to what messages they were to process or not. This could eventually lead to a situation where nurses do not check all messages, or refuses to process them in fear of doing something wrong. One municipal nurse explained how she could monitor the messages, but that they were contacted by telephone if it was information relating directly to them:

> *There is almost no communication (over EME) with the hospital. I can observe that the hospital send messages, but they go through the allocation office. So they use it quite a lot, and when they want us, they call. There is no direct messaging between the hospital, and us as I see it. We can see the messages they send, and the allocation office will also notify us if we have to prepare something before they come home.*

This practicality of the message flow had its advantages as it formalized the electronic communication, and hospital nurses only had one communication to relate to when using the EME system. However, it emerged through interviews with both hospital and municipal nurses that in addition to the messages exchanged with the allocation

office, the telephone was used for direct communication with the homecare. A municipal nurse stated:

> *They (the hospital) don't send any NUC-messages to our department asking any information about the patient, that is always done over the phone. I feel they send messages with the allocation office when it comes to patients home situation, and if there are any changes and such.*

The hospital nurses shared the same view, and also regarded the allocation office as the connecting link between them and the municipal nurses. One nurse from the surgical department stated:

> *We don't know what person we communicate with. It's mainly the allocation office, and then they redistribute the messages to the different homecare departments. We don't use the messages to communicate with the homecare service, just the phone.*

Different routines and communication partners could lead to a delay in the discharge process of patients. The hospital and the municipality's deadlines in communication could lead to a patient being sent home without the homecare knowing of it. As one nurse from the surgical department stated:

> *... In the last message we wrote "the patient is now going home, and you can contact us when he's home". We then send him home, and the next day we got a message that says "if the patient is coming home, we have to have a meeting before you discharge him". And in that case he was already home! And he called us wondering where the homecare was. And then I had to call the homecare… This happens, that we send them home without us knowing if they have read the message or not.*

The quote above can in many senses be said to be a fault made by the hospital nurse in question, as she did not make sure that the message had been read. But it is a good example of how the different routines and communication partners together with the lack of system knowledge could lead to potential pitfalls and delays in the process of discharging a patient. The super user at the inpatient medical department, stated that the allocation office made some things take longer than they needed to. She said:

> *Sometimes it makes us use more time on simple stuff. Where you before could just pick up the phone and said "we send the patient home tomorrow, nothing*

new", and that would be ok. But with EME, you first have to send a message to the allocation office, and they send a message back, and then we have to call the homecare. So some things do take more time.

As stated, some nurses in the hospital said it was beneficial to only have the allocation office to communicate with over the electronic messages as it lead to a reduction in actors and routines:

It was nice to talk to the ones performing the care, who might know the patient. But at the same time, its nice to get away from all the phone calls from the homecare, there is fewer now. Everything goes through the allocation office. So that's a good thing in our hectic workday.

Some nurses stated that they believed the system made communication more efficient, whilst others focused on how they now had several communication partners and routines to deal with. The nurses brought to our attention that they felt it was a problem not communicating with the people who actually cared for the patient on a day-to-day basis. The telephone seemed to be the standard communication method when the intention was to talk with people who had such knowledge. An experienced nurse from the inpatient medical department stated:

I feel we can obtain much better information by making a phone call and talking to the people who knows the patient. The way I have understand it, the people who process and answers the messages isn't necessarily the ones who knows the patient best… When we call the homecare directly we get information about patients home situation and their cognitive function. And information about patient's cognitive function is something we always want, because we don't know the patients. And then we can ask other questions as well. So I think it's nice to talk to the people who knows the patient.

5.6 Informal and formal communication in healthcare

5.6.1 Users still value oral communication

There was a divide among our informants when it came to the potential benefits of electronic and oral communication. Whether they preferred communication to be of an oral or electronic form depended on the communication partner and the nature of the communication. The general opinion among municipal nurses was that

communication with the GPs had improved, both in relation to efficiency and quality, after the introduction of the electronic messages. A municipal nurse stated:

> *I think the information is more accurate, sometimes you can't catch everything the doctor tells you over the phone… I guess it's more secure in relation to patients' medications. The information doesn't have to go through as many steps as before.*

However, several informants both in the municipality and in the hospital especially mentioned the value of small practical details regarding the patients that they felt not could be written down, especially when communicating clinical information between health levels. They stated that the electronic communication was more "final and formal" as it was saved in the patient's journal, and that not all information was appropriate to be conveyed over such a system. A municipal nurse explained why she felt oral communication still was important when communicating with the hospital:

> *I believe that talking to people, and saying what lies between the lines, what you might not dare to write because everything you write can be checked and controlled... To have that phone call, that's important. Then you can say all the small things that would have been hard to write out in a good way. And many times, I think you can say more when you talk with them, than if it has to be written "professionally" and stored in the EPR…. Sometimes I believe its better to pick up the phone instead of writing it down, and worrying if it sounds as professional as it should, or be understandable for the other person.*

Several nurses preferred that the patient-related clinical information was communicated via the telephone, and that this was the current standard. The reasons above was shared by another municipal nurse, who stated:

> *When they call us, they get a lot of information. We know the patients very well. Often we discuss the patient, you know, how their personality is, what they like, what you absolutely should not do, and so on. That's something that can take a lot of time to write in a message. I normally write some of it in the Admission report, but I don't know if it's read (in the hospital)…*

In despite of the system's initial intention to reduce the time spent on phone calls, users in the hospital stated that several municipal services still requested to get information over the telephone, in addition to the electronic messages. One nurse at the inpatient surgical department explained that she felt she had to use oral

communication as a safety net, to make sure that the messages had been read and that information had been conveyed to the correct people:

> *For me, it's just knowing that they (the homecare) know that the patient is discharged and coming home, that they are prepared and that there hasn't been a failure. Its important for us to know that they get a visit from the homecare, that we have a oral agreement as well.*

The uncertainty associated with the messages actually forced the phone call as a second procedure in order to make sure that the message had been read, and that the patient was met at home. A second issue that forced the hospital users to use the telephone was the acute need for patient information associated with a hospital admission. The asynchronous nature of the EME system didn't fit with the need for patient information. A nurse from the inpatient surgical department told us:

> *You want things to go seamless and fast. If I want an answer to if the patient can eat by himself or not, I need an answer fast, you know. Then I would prefer to call the people who know the patient rather then send a message. Maybe if the system had been faster…*

The asynchronous nature of the system, along with the fact that the allocation office was the most common communication partner for hospital nurses, made the telephone and oral communication the preferred communication method among several of the nurses:

> *Its easier to call, you don't have to go through an extra person, you can talk directly to the ones caring for the patient. The EME is a lot of paperwork and is characterized by a lot of waiting. It can take several days before everything is settled and dealt with. And that's a bit cumbersome.*

An experienced nurse from the inpatient medical department told us that she worried that some information would be lost if healthcare was to be characterized by solely electronic communication. Like the municipal nurse above, she made a point of the "non-writable" information, information that could only be conveyed in its informal nature. She stated:

> *We can replace some of the oral communication, but I believe it's important as well. We can loose something on the road from oral communication to only*

using the computer… It's not everything you can write down. It can be information about "difficult" relatives. You know, there are a lot of things like that. If it's written down, it's written down. Of course, you have to stand up for what you write, but its something with the way some information is communicated that gets lost with only using the computer.

5.6.2 A wish for increased exchange of nursing related information

Users in both the municipality and at UNN wished for an increased electronic exchange of nursing related information across health levels. When asked if they had direct communication with nurses on other health levels over electronic messages, all informants stated that they had never used the feature, and that they did not know it could be done. An experienced municipal nurse who was an EPR super user said:

It's almost no nursing related information exchanged between the hospital and the municipality over the EME system, that's not a tradition, except for now and then when we get a nursing summary. So if you could have exchanged more nursing related medical questions that would have been very interesting.

Users in the hospital stated that the majority of electronic communication with the municipality was conducted with the allocation office, often to plan meetings and discuss patient's needs for health services. Several stated that direct message exchange with municipal nurses would be useful, whilst others thought it would not fit with the needs of the hospital, as synchronous communication would be preferred due to patients' more acute situation. If such information was needed, users in the hospital could not wait for answers from municipal nurses. Another issue was the shifts and high turnover in the hospital; the lack of continuity in the workforce would make such direct asynchronous communication difficult. A nurse from the inpatient surgical department stated:

It could be useful if the municipality knows the patient. Then they know him much better than we do… But I believe since we are so many nurses who share the responsibility for the patient… They might have a new nurse each day, and then its not followed up in the same way. If a dialog is started, maybe another nurse don't get what I have started. If we have had the same patient for a week, I believe it could be useful, but as we have that kind of shift system, I don't think the follow-up would be that good.

114

6 Discussion

In this chapter we will highlight and discuss what we believe to be the most important findings in our study. The main issue that influences the use of the EME system is the distance between intended system use and the actual work practices it is supposed to support. Where the system seems to facilitate for an asynchronous form of communication, hospital users are dependant on a more synchronous method of information exchange. Another issue is the fact that the system seems to mainly support secondary outcomes for hospital users, while generating articulation work and double routines. We will discuss how users manages new routines, and what consequences it imposes on their daily work practice.

We begin this chapter by presenting a table that reviews the electronic message exchange in a more tangible way; its different pathways, intended use, clinical value for users and final outcome. This table is meant to summarize the findings in relation to specific message types, while at the same time illustrate what the actual outcome and consequences are.

Message pathway	Message type	Intended use	Actual use	Clinical value for users	Consequence
Municipal user → GP	• Request • Answer to request	Exchange of clinical information. Several message standards for specific requests.	Exchange of clinical information. Only free-text messages are used.	High value	Regularly and frequently used. Replaces old routines for municipal users.
GP → Municipal user	• Request • Answer to request	Exchange of clinical information. Several message standards for specific requests.	Exchange of clinical information. Only free-text messages are used.	High value	Regularly and frequently used. Replaces old routines for GPs.
Allocation office → Hospital user	• Request • Answer to request	Logistic and administrative information.	Plan meetings and discharges.	High value	Regularly used. Gives administrative benefits.
Hospital user → Allocation office	• Request • Answer to request • Logistic messages	Logistic and administrative information.	Plan meetings and discharges.	Low value	Hospital users experience this an additional work routine. Gives administrative benefits.
Hospital user → Municipal user	• Request • Answer to request	Exchange of clinical information	Rarely used. Users not aware that this message exists.	Low value	Clinical information is exchanged mainly by telephone.
	• Message of admitted patient	Inform the municipal care service of the admittance, automatically generated and sent			
	• Early alert	Inform the municipal care service of the expected date for discharge.	Dates based on educated guesses.	Low value	Users experience duplication of routines. Confusing routines; some municipalities want to be informed by telephone while others want the electronic messages.
	• Discharge summary	Clinical information and summary of hospital stay.	Different routines with different municipalities. Several routines used, both physical and electronic copies sent.	Low value	Users experience duplication of routines. Creates redundancy. Municipal users express low consistency as summaries arrives electronically or in physical copy.
Municipal user → Hospital user	• Request • Answer to request	Exchange of clinical information.	Rarely used. Users not aware that this message exists.	Low value	Clinical information is exchanged mainly by telephone.
	• Admission report	Clinical information about newly admitted patient.	Complicated routine and confusing message standard, results in message containing little and old information.	Low value	Hospital users express that this message contains little relevant information. Arrives too late to be relevant for treatment.

116

6.1 Expanding the installed base with the EME system

6.1.1 Considering the installed base when introducing new IS

Both our hospital and municipal informants told us about how the EME system in a limited manner supported the exchange of clinical information across health levels. In this section, we will draw on concepts from II theory in order to create a framework for understanding the reasons for this. According to Hanseth and Monteiro, systems, artefacts, and the people in organizations are part of the complex, evolving and heterogeneous sociotechnical networks they call information infrastructures (30). This definition assumes that changing and expanding the II depends on multiple factors, and that these factors must be seen in relation to each other. An II perspective can thus help to explain how the existing systems and practices may both facilitate and inhibit change when implementing new ICT.

A prerequisite for II's to evolve are that new modules are integrated and able to communicate with the already existing infrastructure, i. e. the new and the old must be interoperable. This entails that new modules must interoperate with the heterogeneous already installed base, consisting of both human and non-human elements (30). Following this notion, new modules must fit with both existing work practices, as well as organizations' existing information systems. One consequence when introducing new systems, like electronic message exchange, into the already complex networks, is that they can inherit the strengths and limitations of the installed base (32).

It seemed as the EME system to a certain degree failed to support the exchange of clinical information between the actual users in primary and specialised care. A clear example of this was the Admission report sent from municipal nurses to the hospital when a patient was admitted. It was supposed to support the exchange of relevant clinical information about the patient and give hospital personnel insight in what led up to the admission. It was constructed in such a way that certain information in the municipal EPR was automatically included to contribute to a more comprehensive information exchange. Our informants especially mentioned the automatic inclusion of pharmaceutical information and the IPLOS-score. However, for municipal users,

117

the message's structure was experienced as messy, and because of a lack of updated information in the EPR, content was experienced as insufficient. Hospital users shared some of the same opinions; the content was often perceived as insufficient, and they felt it reached the hospital to late for providing valuable information. When they actually got the message, they had usually obtained the information by using other methods of communication.

We argue that the limited possibility to exchange clinical information over the Admission report cannot merely be seen as an issue of message structure and technical features. It must be looked at in light of the sociotechnical network the new system is a part of. For the message to support the actual exchange of clinical information across health levels, it is actually dependent on certain features of the already installed base, like the updated pharmaceutical information in the municipal EPR. Through our informants, we learned that this information was rarely updated due to the amount of work it demanded. In other words, for the Admission report to fulfil its purpose of supporting the exchange of pharmaceutical information, a prerequisite was that municipal work practice actually allowed nurses the opportunity to keep such information updated. In line with Hanseth and Monteiro's argument that the new modules of an II must be interoperable with the existing installed base, we argue that in certain scenarios, the EME system and existing municipal work practices was, in deed, not interoperable enough to sustain the intentions of supporting exchange of clinical information across health levels (30). In the case of the Admission report, the same can be said about interoperability with the hospitals work routines. The asynchronous feature of the report did not interoperate with the hospitals existing need for more acute information exchange.

When hospital nurses were sending other messages, our informants described a more general discontent with using the system, as the new communication routines mainly was experienced as additional work tasks with minimal value to their work. They explained that the telephone was still the most commonly used communication method to support exchange of clinical information. This could also indicate that the already installed base of technology and work routines was not taken into consideration when designing, or deploying the EME system in a complex

environment as specialized care. The fact that the nature of specialised care is so inherently dependent on a direct and synchronous transfer of clinical information can indicate that the asynchronous EME system might not be suitable for this organization at all, at least not the way it is currently organized.

6.1.2 Establishing the EME system by cultivating growth

When looking at what our informants in the two organizations said about message use, there was an obvious gap in how beneficial users found the system to be. As argued, this is probably a multifaceted issue where multiple factors come into play. The system was made to support multiple diverse and local work practices found in primary and specialized care. This led electronic communication to generally be experienced as beneficial between municipal nurses and the GP, while hospital nurses felt that the messages failed to support them directly in their day-to-day work.

As mentioned in our theory chapter, one of the primary goals when changing an II, or building a new one, should be to make the installed base self-reinforcing by making it gain momentum (29). One of the main issues encountered when designing new II's, is that they never "take off", and that this initial growth is hampered in some way or the other. What designers have to do in order to avoid this scenario is to cultivate conditions that allow for self-reinforcement, and make it gain momentum by persuading as many users as possible to appropriate and use new applications. Cultivation involves designing for initial usefulness, i.e. new applications or features should give users immediate benefits, which will motivate them to appropriate and make use of the system. Hence, it should also be easy to learn. The installed base should then be expanded fast by persuasive tactics, which involves finding as many users as possible. When users experience positive feedback, there is an improved chance for new applications to become self-reinforcing. Another point is that new functionality should only be added or integrated when it is needed and have a large enough users mass.

In the case of the EME system, the FUNNKe project can be said to be the "designers" of this new infrastructure. FUNNKe's initial goal was to make sure that all municipalities and hospitals in the northern RHA was communicating electronically

within 2013, in order to support quality and efficiency in delivery of healthcare (70). Though not designers of the system it self, they were responsible for cultivating the conditions in order to make the system "take off", and become a well-established part of the infrastructure. Accordingly, their goal of implementing the system in all municipalities and hospitals within a relatively short timeframe was probably a wise decision. They followed the suggestion from "One inhabitant – One journal", which encouraged a coordinated system introduction within each region (68).

By following this strategy, they basically enabled the possibility of positive feedback for system users as it were supposed to facilitate several communicating actors. However, hospital nurses told us that training in the system came on a stage were there were few municipalities to communicate with, which hence made them dependent on several systems for inter-organizational communication. Even now, three years after the start of implementation, they still experienced the EME system as unreliable since they did not receive answers from all municipalities. It could thus seem as the FUNNKe project had failed in establishing the required user-mass needed to sustain self-reinforcing communication routines between the hospital and surrounding municipalities. The situation appeared to be somewhat better when communicating with Tromsø, as they were one of the largest, and first, municipalities included in the project. Yet, even in this relationship, hospital nurses did not seem to acquire particularly high practical value towards the messages in relation to their everyday work, which could further indicate that the system had failed to present its primary users with the initial usefulness needed to provide sufficient momentum.

In communication between homecare and GPs, however, the situation seemed to be the other way around. Both actors experienced immediate benefits from the system, and explained that it would be difficult to go back to the traditional routines. Municipal nurses told us that they quickly had become dependent on the system, and that they experienced a lot of frustration when one GP's office was lagging behind on implementation. They were in particular satisfied with the free-text messages they could send to the GP. The most prominent example of municipal nurses experiencing frustration surfaced when sending the message Admission report to the hospital. They stated that this message had a complicated structure, and was highly dependent on

already existing information in the EPR. This could suggest that the simple, easy-to-understand, free-text nature of communication with the GPs was a good starting-point when establishing the user base needed to cultivate system self-reinforcing. More advanced messages like the Admission report, should might have been introduced when such functionalities was requested by users, and actually needed. Hanseth and Lyytinen states that new functionalities should only be added when it is desirable, and when the user-mass is large enough to justify the cost of introducing additional functions (29). As exchange of clinical information still appears to be communicated over the telephone, and that users value its informal nature, suggests that it is not a functionality actually requested by the users themselves. The fact that the message was described as complicated could also indicate that the proposal to make new technologies, in an II-perspective, easy to learn was not followed.

6.1.3 Timing of user education is essential for appropriation

Our informants were divided between those who had been given structured training, and those who had not. Both at the hospital and in the municipality, the majority of users stated that there had been little, if any, systematic training. As mentioned in the Findings chapter, the strategy had been to educate super users who would then carry on the task of system education at their individual departments. This centrally organized training had been conducted when the message system first was introduced. The time of the education seems to have played an imperative role in how the users where able to appropriate the system.

When the education was initiated in the hospital, few municipalities had properly implemented the system and started using it. This meant that hospital nurses had the theoretical basis for using the system, but few municipalities to actually communicate with over the message system. The process of preparing the smaller municipalities for electronic communication has been, and still is, an on-going and unfinished task. As a result, the nurses could not utilize the message system after they had conducted the training since they had few communicating partners. Expecting users to maintain their knowledge about proper system use without giving them the opportunity to actually use it seems optimistic at best.

The users in the Municipality of Tromsø had a different basis for adopting the system as the GP offices were having the system installed in a more coinciding fashion. This gave the municipal users a chance to utilize the system at an earlier stage than hospital users. It is true that the system rollout has been fragmented amongst the GPs' as well, but not to the same degree as with the smaller municipalities.

According to Hanseth and Monteiro, education and training can be regarded as inscriptions (30). In doing so, we can use ANT to examine the different degree of user adaptation and satisfaction, or in other words; why the message system manages or struggles to establish itself in the actor-network. Both the municipality and the hospital used the same education strategy, and it is thus fair to expect a more similar rate of adaptation and use in the two organizations. But given the different circumstances mentioned above, it becomes clear that the timing of the education was a key factor. If we regard the education as an inscription, we can argue that they possess the same strength; their ability to get users to adopt a desired routine is the same in the municipality as it is in the hospital. If we then isolate the actors in the network and look at them separately the differences becomes clear. The network consisting of municipal nurses and the GPs are far more aligned than the network consisting of hospital and municipal nurses due to the amount of readily available actors. This proves that a same-strength inscription has a different effect on a more aligned network with a sufficient number of allies (82). It thus seems as the execution capability of FUNNKe to simultaneously implement the system among all actors in the region was weaker than expected.

6.1.4 Templates and guides discourage system use

Following Hanseth and Monteiro's reasoning, we argue that the templates and guides represent a main inscription designed to achieve the desired message exchange routines (30). As mentioned in the Findings chapter, a guide for intended use was available in both electronic and physical copies at the departments. Hospital users stated that they would use the guides when they were unsure about how to proceed with a message routine. We did, however, find that most informants found the available guides confusing, and some stated that they further confused the situation rather than clarify it. This was in large due to the strictly confusing design of the

guides, and one informant stated that the actual procedures tended to be easier than what the guide illustrated. Several informants pointed out how the sheer abundance of arrows and boxes in the guides lead to confusion. Hospital nurses would rather postpone the message routine, and complete the task when they had a colleague they could ask rather than use the available guides. Although the users felt like this method provided a more qualified answer, the fact is that most of the users stated that they were self-taught in system use. This implies that answers would be based on individual perception of the correct routine, and not the actual intended ones. The guides, because being poorly designed, thus stand out as a weak inscription.

The fact that the message exchange system has been appropriated to a greater extent in the municipality than in the hospital, illustrates how the accumulated and combined strength of the inscriptions, combined with more aligned interests in the actor-network, has achieved to obtain the desired patter of use.

6.2 System use in multiple contexts

6.2.1 Asynchronous communication in a synchronous environment

There is no doubt that changing, removing or introducing new tools or systems into the complex organizations we find within healthcare leads to consequences that will inevitably affect existing work practices. The introduction of the EME system is no exception, and had consequences for work practices in both primary and specialized care. However, the most visible effects seem to have been caused in the hospital. Our informants told us how they experienced new communication routines to hamper workflows, create additional work tasks, and mainly support more administrative secondary outcomes. The telephone was still in widespread use, and often the preferred method of communication when exchanging clinical information.

In his paper from 1999, Marc Berg argues that an in-depth understanding of the settings systems are to be introduced to should be the starting point for design (3). Especially for healthcare this seems relevant, as the value of systems can only be maximised through the interplay between the system and its users. Hospital nurses told us that they recognized how the system potentially could add value to their

workday by ensuring safer and more formalized communication between health levels. However, the overall experience was that it leads to an increased workload and additional work tasks. We argue that this is an expression of how features of the system matched poorly with the way work is organized in specialized care. Bannon and Schmidt argue that computer system must be seen as an organizational change-agent above all other due to their high grade of flexibility (12), but when existing work practices are organized in a way that differs so profoundly from how the system is designed, there is a risk that unintended consequences succeeds the initial intentions of the system.

Each hospital department we recruited informants from had approximately 30 hospital beds and 50-60 employees. Beds were almost always full, and they often had to keep patients in hallways because of overlay. This increased pressure to get patients discharged, as there was always someone waiting to be admitted. Our informants told us that they were dependent on obtaining patient information as soon as possible after admission because of patients' often-critical situation. When planning discharge of patients, and other practicalities, they were also dependent on quick answers to clarify the situation and plan ahead. The amount of critically ill patients, their situations, number of employees, and their intensive job rotation created a hectic and unpredictable work environment. Berg states that it is the complexity of healthcare that forces this environment, and that emerging sudden events in such organizations has to be dealt with on the spot, with whatever resources available (3). This in turn indicates that communication and collaboration should be of a synchronous nature in order to support this on-the-spot problem solving. The EME system, however, does not facilitate this way of communicating.

The EME system rather facilitates asynchronous communication, where the only thing regulating when the receiving actor answers a message is the obligated messaging routines. Hospital nurses told us that when a patient was admitted, the routines (when followed) allowed 48 hours to pass before the hospital message Admitted patient is answered with the municipal Admission report, which is supposed to contain critical clinical information about the patient. In this time, they had already applied other means of communication, like the telephone, to actually obtain the

information they needed. The messaging routines were therefore often experienced as an additional work task, as they either way had to call municipal services to acquire the relevant health information they needed fast enough. Ash et al. emphasizes how unintended consequences like such additional work tasks can hamper the achievement of systems initial purpose like streamlining work and increasing quality (13). In this case, it can be argued that such unintended consequences probably could have been foreseen, as the systems initial purpose was to replace the telephone with the asynchronous electronic messages.

Hospital users told us that the electronic messages rarely supported them in their daily work, and that they were rather considered as an additional work task, without any direct value. As most of the communication between the hospital and the municipality was conducted with the municipal allocation office, information exchange was seen as an administrative task, involving planning of discharges, meetings and so on. In other words, hospital nurses experienced that the messages mainly supported secondary outcomes. The goal when introducing new IS in healthcare should be to create circumstances which allows IS functionalities to transform both primary and secondary work processes (like administrative and managerial tasks), while at the same time aligning these processes (2). For hospital users, this alignment was not visible, as they experienced the messaging system as a media to convey administrative and logistic information, while the telephone still appeared to be the most frequently used communication method for exchange of clinical information. The primary goal in order to achieve alignment and synergy between primary and secondary work tasks should be to create a work environment with an inherent willingness to learn and develop the IS (2). When users fail see the direct value of the system they are using, and rather experience it as a must-do procedure, it is obviously more challenging to get them to take interest, appropriate, and take ownership of the system.

In order to stimulate a work environment with the inherent willingness to learn and develop the IS, a continuous evaluation of the implementation is required. It should be recognized that the implementation process is characterized by deviations, surprises and conflicts, which have to be solved along the way (16). In the hospital however,

the FUNNKe-project's training strategy was to educate system super users and leave them with the responsibility for further training of new employees. The NUC super user we interviewed stated that she had been, almost randomly, chosen as a super user, without receiving any proper, formalized training. She experienced that almost everyone in her department was self-thought in how to use the system, and that new employees often struggled with using the system in the correct way. We argue that this could be an expression of an absent on-going evaluation of the systems implementation process, as the training strategy had not been revisited until recently. In addition, the EME system was a project grounded and initiated on a national level. In that regard, it can be viewed as a large-scale system rollout, where responsibilities had been distributed to regional projects like FUNNKe. When an implementation process is viewed as a rollout, there is a risk that challenges are misinterpreted as user resistance and suboptimal returns of the IS (2). According the White Paper "One inhabitant – One journal", FUNNKe is the regional project in charge of system propagation, and hence had the dedicated responsibility to deal with such issues (68). The situation described above seems to indicate that hospital users still struggle with the same issues as they did when the system was introduced. The absence of an on-going evaluation appears to have lead to a situation where unintended consequences were not revealed, and dealt with, as they emerged.

6.2.2 New work routines achieved through shared interests

Informants from the municipality told us that they used the message system several times a day. The messages directly replaced the routine of communicating over the telephone when the nurses needed to consult the GPs. This gave them a strong initiative to absorb and appropriate the new work routines and technology. The same is true for the GPs. The asynchronous message communication was a routine that fitted their workday better than the telephonic communication. If we isolate this setting, the GPs and the municipal nurses, we argue that the network appears stable. From an ANT perspective, where the nurses, GPs and the electronic message system represent equal actors in the sociotechnical network, they all have an interest in utilizing the system (38). Using what we presented in our Findings chapter, we can identify the individual actors' interest and see how they align.

Our municipal informants stated that the dialog messages allowed them to send a request to the GP when it suited them. This is in contrast to the communication done over the telephone, when they often experienced that they were placed in queue and had to spend time waiting just get access to the GP. Several informants felt like this idle time was wasted, as they could not perform other tasks while queued. The messages allowed them to place an inquiry when in suited them, and not spend time waiting for a direct reply. This form of communication fitted better with their work practice; they could send a message in the morning, and then continue with other tasks and check for a reply later. As much of their work was done outside of the office, this freed up the idle time previously spent waiting in queue. This direct benefit reinforced and made their compliance to regularly check the message inbox more durable (38). Since they often had an on-going dialog, they would access the message system more routinely. We argue that this represents that the direct benefit translates to their *interest*. Considering what we presented in our Theory chapter, a desired, specific work routine can be inscribed into different materials. These include, but are not limited to, icons, guides, and templates. It is difficult to know what inscription, how strong or what type, is needed prior to implementation and actual system use. Different inscriptions are hence introduced into the sociotechnical network, in a way that superimposes the inscribed work routine (30). In this case, the inscription for regularly checking the message inbox and achieving a generally accepted routine for the task is too weak in the hospital. The municipal users do, however, have an established and accepted routine to checking the inbox. According to ANT, successful inscriptions make the action, or work routine, mutually desirable for all actors in the network, aligning interests and obtaining a stable network.

6.2.3 Message notification – a small but important feature

One of the strongest inscriptions we found was the blinking icon signalling the municipal user that they had unprocessed or new messages. They were presented to the icon immediately after they had logged in to the EPR, and it was located on the home screen of the system. This gave the nurses easy access; the message inbox was only one click away. At the same time it made it difficult for them to ignore, and they were "forced" to check the inbox in order to remove the blinking message icon. As presented in the Findings chapter, several informants mentioned this icon as an

important feature for supporting frequent use of the message system. This is supported by the fact that municipal users regularly checked the inbox.

The hospital EPR did not support such a feature. Informants we talked to specifically pointed to the potential usefulness of such a function, and made parallels to the notification when you receive an e-mail. Compared to municipal users, hospital users rarely checked the message inbox, and stated that they have few established routines for checking on a regular basis. They explained that this lead to messages residing unprocessed in the system for an unnecessary long time. Another aspect that lead to messages not being processed or read in the hospital, was the fact that the inbox was far less accessible than it was in the municipal system.

The notification icon is not solely responsible for the fact that municipal users have a more incorporated routine for checking the message inbox; the situation is far too complex. It does, however, stand out as an important, single feature to support the intended system use. The fact that hospital users request the same function in their system, without knowledge of its existence in the municipal system, illustrates how important that inscription is, or would be.

6.3 Cooperation across complex settings

6.3.1 Supporting inter-organizational cooperative work

Rollout of the EME system on a nationwide scale must be seen in relation with the Norwegian Collaboration reform set in motion in 2012, and was an initiative to increase the quality of collaboration across health levels in order to support correct information at the right place at the right time. The goal was for the patient to receive treatment closest to his home, and to allow municipal services to be more prepared and able to receive more critically ill patients from the hospital (17). Schmidt and Bannon argue that people engage in cooperative work when there is a relationship of mutual dependence, and cooperative work is needed to accomplish the work (19). In this regard, improving the infrastructure for communication across healthcare levels can without a doubt be seen as a mean to better support cooperative work.

As mentioned in the previous section, specialised work practice is characterized as more complex and messy than primary work practice. The amount of hires, number of professions, high turnover, intensive job rotation and more critically ill patients makes specialised healthcare practice a structurally complex field of work. According to Schmidt and Simonee, this also increases the distributed nature of the work performed (20). In municipal homecare services, there are fewer employees, more clinically stable patients, a lower degree of turnover and less intensive job rotations. However, when discussing cooperative work, you can not look at organizations as separate, as cooperative work is rather defined by the actual cooperative behaviour (19). When looking at the two organizations together, the structural complexity becomes even greater, and the distributed nature of work increases. Coordination of work has to take place across the two organizations, which increases potential collaborative challenges.

Schmidt and Bannon state that the more distributed the cooperative work is, the more articulation work is needed to coordinate, align, mesh and integrate work tasks (19). Introducing the EME system led to a situation were the articulation work needed to organize the discharge of a patient was transformed from an informal nature, accomplished by primarily using the telephone, to the EME system. By transferring such secondary work tasks of a more clerical nature, to a system of its own, it can be argued the articulation work needed to discharge patients was split into two different and distinctive workflows. Hospital nurses still had to exchange clinical patient information via the telephone, while at the same time exchanging information of a more clerical nature electronically with the municipal allocation office. The creation of the municipal allocation office, where the administrative aspects of municipal healthcare was moved further away from the actual conduct of care, stimulated this splitting of communication routines based on the nature of information. It can be argued that if allocation of services and other administrative tasks were conducted in closer collaboration with the municipal nurses, the information gap would be conceived as narrower, and more closely related. This could in turn have led hospital nurses to experience a more direct communication between them and municipal personnel with day-to-day patient contact.

Following the line of thought above, it can be argued that the introduction of the EME system actually increased the distribution of the cooperative work taking place between the hospital and the municipality, thus creating an increased need for articulation work to support the discharge of patients, as it now demanded two different systems; one for clerical information exchange (electronic messages), and one for clinical information (telephone) (19). The EME system also increased the amount of training new employees needed, as it demanded that all hospital personnel knew when and how to use it, in addition to knowing which municipalities had the system implemented well enough for practical use. With UNN covering a total of 87 municipalities in its function as a university hospital, this seems as a daunting precondition.

For the nurses in the municipality of Tromsø however, information exchange of a more clerical nature was maintained by the administrative caseworkers in the allocation office, and the system was mainly used to support communication with GP's. Nurses therefore did not experience the same emergence of additional work tasks. They told us that messages had revolutionized communication with the GP, and one even went as far as calling the messages *"…the best thing that had happened…"* to them. For municipal users, the system had opened up idle time formerly used to wait in telephone queue, while at the same time making communication more straightforward, as they now could send a message directly to the GP. It also allowed for more convenient communication, as none of the actors had to wait for the other in order to initiate or complete a round of communication. The information had become more comprehensive, as there was room to write out complete stories about patient situations. When assessing these statements, the EME system actually reduced some of the articulation work needed to communicate with the GP for municipal nurses, and visa versa, due to the lower level of distribution in cooperative work between the actors.

Within the hospital, our informants told us that the system had forced forward the unexpected consequence of searching for physicians in order to complete the message that notified municipalities of discharge-ready patients. This was a new task hospital nurses found them selves responsible for; tracking down physicians in order to remind

them to perform their own tasks. Hospital nurses also explained how they often had to pick up the telephone and call municipalities when they failed to answer messages. They could not be sure that the messages had been received, and felt a need for making sure messages had been processed, in order to not send patients home without municipalities knowing of it. Municipal nurses on their hand stated that their patients on several occasions had been discharged without them knowing about it, or without essential information regarding the hospital stay and current health status. This caused both municipal and hospital nurses to make use of traditional communication routines, such as the telephone, for more reliable exchange of clinical information.

In order to help reduce the cost of doing articulation work, coordination mechanisms like protocols, formal structures, standards, plans and procedures can be introduced (19). To streamline electronic communication over the EME system, standardized messaging routines had been introduced in order to bring the cooperative activities together and make them part of a larger system. These routines told the different actors what messages they were to send in certain situations. In the municipality, where administrative personnel and care personnel had access to the same messages, it was also necessary to specify what messages each actor was to process. Our informants stated that coordination mechanisms describing message use was complicated, hard to use, and thus of low value. In addition, the allocation office was often perceived as a bottleneck in electronic information exchange. As information had to be conveyed through an additional actor, it could also increase the potential for error.

When our informants talked about how electronic communication supported exchange of clinical information between the hospital and municipal care personnel, nurses in both organizations told us there were often deviations from the pre-set routines. Based on these statements, it could seem as the coordination mechanisms to a certain degree had failed. Møller and Dourish argues that such procedures developed for special contexts make sense only because of their shared meanings (22). As mentioned earlier in this chapter, hospital users had the impression that messages gave low value related to nurses work procedures, and it may thus seem as the coordination mechanisms in this case lacked the "shared meaning" among its users. Bannon and Schmidt also

argues that because of the complex and distributed nature of healthcare work, it is problematic to formalize workflows into standardized procedures, and that task allocation and articulation in such organizations must be negotiated and renegotiated continuously (12). The tension generated when certain communication standards are meant to support multiple, heterogeneous work-settings must be taken into consideration, and attempts must be made to prepare organizations in advance. Ellingsen and Monteiro suggest that instances of disorder are immanent in integration efforts that imply standardization across both practises and systems (11).

In the White Paper "One inhabitant – One journal" from 2012, it is stated that message exchange functions optimally when the patient-trajectory is pre-planned, and that it is more challenging to obtain the correct information in the case of unforeseen events (68). As healthcare is described as inherently complex and characterized by constantly emerging sudden events (3), we argue that the wish for electronic messages to support all aspects of inter-organizational cooperative work between healthcare personnel therefore seems somewhat optimistic. Our empirical foundation has also allowed us to unveil a creation of new, and somewhat unexpected, articulation work as well. These effects would have been more challenging to predict, but we argue that they could have been recognized at an earlier stage.

6.3.2 Informal interactions necessary for exchange of clinical information

Our informants told us that most electronic communication between specialized care and primary care today went through the municipal allocation office. The nature of the communication was primarily administrative, and the messages "Request" and "Answer to request" was used to communicate and plan discharge of patients. Both hospital and municipal nurses told us they never had sent dialog messages directly to each other. In addition, the messages supposed to contain clinical information according to the messaging routines (i.e. the Admission report from the municipality upon admission and the patient summaries from the hospital upon discharges), was often either insufficient for use, or they never reached the receiving actor.

Following the arguments in the section above, the fact that messaging routines gave users little direct value could contribute to explain why messages were not sent when

they were supposed to. The same can be said for the Admission report, as several of our municipal informants told us that the message's structure was somewhat complicated and difficult to fill out, which could make it incomplete. Both hospital and municipal users told us that they valued conveying clinical information about admitted or discharged patients over the telephone, even when they had the theoretical opportunity of sending such information electronically. They emphasized that they could not communicate small practical details over the messages, that messages were more "final and formal" as they were saved in the EPR, and that not all information was appropriate to convey over such a system.

Schmidt and Simonee states that computer systems frequently evolve around supporting information flows, in despite of it being a highly idealized and inadequate method for modelling the articulation work of real world settings (20). They argue that an important part of these information flows are the informal interactions between actors in cooperative work. Informal interactions can function as human support networks and mediators of companionship, and can actually be crucial for the actual conduct of work processes (12, 20). It appears that our informants deemed such informal interactions as essential to support sufficient information exchange across health levels, but that the EME systems was not good enough to support them. Trying to reduce the informal interactions by reducing the use of the telephone could also lead to users loosing the sense of belonging to the same healthcare system, and increase the perceived distance between primary and specialized care.

Municipal users, on the other hand, did not mention such informal interactions as a necessity for communication with the GP. We argue that the reason for this is a combination of several factors; the patients are usually well known for both the homecare nurses and the GP, the number of potential communicating partners is lower (few GPs and nurses), and patients' situations are usually more stable, thus removing the need for acute information exchange. In addition, municipal users generally wrote in free-text, possibly creating the impression of informality. When municipal users exchanged messages with the GP, they usually received an answer to a question they had asked. This meant that municipal users, in most cases, were aware of why the GP came to his or hers decisions, and the system was in this regard

transparent. Bannon and Schmidt states that cooperative decision-making must involve a continuous process of ensuring and validating information produced by other actors (12). The fact that actors knew each other well, and had a mutual dependency between them, along with how communication was based on questions and answers, allowed both actors to apply some mutual critique to decisions. Both actors had the possibility to go back and track what led to decisions, and the background and context of the decision was usually clear.

The paragraph above describes a well functioning shared workspace, where actors can go back, and understand why communicating partners came to their decisions. The EME system does not facilitate such a transparent shared information space for communication between the hospital and the homecare services. The amount of possible communicating actors is much larger, and the work practices are further apart and more heterogeneous. In addition, as the hospital primarily exchanges administrative information with the allocation office during the hospital stay, municipal nurses only have the patient summaries to relate to, which according to our informants rarely described the process of reaching the decisions made by hospital personnel.

6.3.3 Redundancy to ensure robustness in communication

Informants from the municipality told us that the EME system contained several different message standards that were supposed to be used when communicating with the GP. These standards were designed to be used in relation to the topic of the message. You would for example use a different standard for a message regarding a patient's next appointment than you would for a message about the patient's medication. The nurses told us that they had used the different messages standards when the system first was introduced. This had, however, resulted in confusion for the GP and unnecessary redundancy of information, as the messages automatically imported information from the EPR. For each message in the dialog, the EME system would import the same information (patient history, allergies etc.).

This extensive attempt at standardising the information exchange by forcing the nurses to use the pre-set of standardised messages seems to fit poorly with their actual

needs. The users however, easily circumvented the discontent with the intended system use, as they chose to utilize the free-text messages exclusively when sending dialog messages with the GP. By allowing for that flexibility to take place, the users now have appropriated the system and finds great value in using it instead of the telephone when communicating with the GP. We argue that the attempt at standardising the work routine of communication between the municipal nurses and GP failed to appreciate the actual needs of the users. Circumventing the intended use of message standards also contradicts one of the main reasons for standardizing healthcare information; namely that information and data should be available for secondary use. One of the stated propositions in the White Paper "One inhabitant – One journal", is that information should be accessible for use in research and health monitoring in the general public (68). This is only possible if data and information is standardized through pre-sets, such as message standards. By only utilizing the free-text option, the data and information that is generated and exchanged cannot be reused for other purposes.

Several informants stated that some of the new routines brought on by the EME system failed to replace the traditional existing routines. This lead to a duplication of work, where the same procedure had to be performed twice, but with different technologies and artefacts. This created a redundancy in the form of double exchange of identical information. This was especially the case when the hospital nurses were to send the patient summary after discharge. The EME-procedure states that this should be sent electronically to the municipality. The nurses did, however, experience that municipalities failed to acknowledge the electronic copy, and would demand that the hospital sent the summary in a physical copy with the patient when discharged.

As mentioned earlier, the municipal nurses spent the majority of their workday out of the office. This could be the reason to why they failed to see the summary when it was actually needed. The municipal nurses would meet the patient at his home when he was discharged, and when the summary was being sent solely in electronic copies, they would not be able to access it when they needed it the most. The action of sending a physical copy can therefore be regarded as an action that supplies robustness to the information exchange (23). When the patient was discharged with a

physical copy, the municipal nurse would have access to it when the patient arrived at his home. This is further supported by the fact that only homecare patients would be discharged with a physical copy. For the patients living in the residential care home, the electronic summary would suffice as the nurses working there had better access to computers and the EME system.

Our hospital informants also stated that they often received no answer from several of the smaller municipalities. This was not limited to just one sort of messages, but seemed to be a recurring phenomenon. As the EME system envisages that all information exchange and communication should be performed via the messages, this proved problematic. The nurses could not be sure if the messages had reached the receiver, or if they had been processed or not. This resulted in that nurses, in addition to the messages, had to call the receiving municipality to confirm that the message had arrived and had been read. This additional routine acted as a safeguard to the system, and makes the information flow more robust. As most users were not aware of the application messages that would alert the sender if the message failed to reach the receiving end, this was the only way they had of performing quality controls. Even though redundant, the telephone provided the users with an ability to circumvent errors and obstacles.

It must be acknowledged that it is more achievable to recognize the factors described in this chapter in retrospect. Even though FUNNKe had the primary responsibility for system implementation and dealing with unintended consequences, it must be recognized that the issues we have mapped out here might not have been realistic for the project management to actually deal with, no matter how careful the implementation had been planned. However, we still argue that the implementation process has suffered due to the lack of an on-going, systematic evaluation focusing on end-user perspectives.

7 Conclusion

This empirical study of the national message exchange system is aimed to serve as a partial evaluation within a local context, based on user experiences. The focus is justified by a neglected user-perspective in already existing evaluations and reports. Most of the prior reports regarding the system focuses on benefits and effects higher up in the managerial structure. This motivated us to dig deeper into the subject in order to map out what opinions end-users actually held, and how it affected their work. We also submerged ourselves into the origin of the EME system and national health-ICT initiatives to achieve a broader contextual framework. The process has been interesting, and yielded diverse results of a complex nature. We have mapped out several distinct, and other more ambiguous, conditions that lay the basis for how the system was perceived by the clinicians who use it on a day-to-day basis.

Through our study, we found that timing of implementation and the training of users proved to be essential. When the message system was implemented and training was given in the hospital, the users had few partners to communicate with. This meant that hospital users did not get a chance to use and sufficiently familiarize themselves with the system until a later time. As the implementation in the municipality of Tromsø and in the GP offices were more coinciding, and the actors more homogenous, users had the opportunity and willingness to adopt and use the system at an earlier stage. This led to the current situation, where the system appears to be accepted among one set of actors, but not between others. It is important that new functionalities and new routines are introduced at a time that makes sense to the actual users in order to obtain the needed user-mass, and become accepted as a part of their workday. In FUNNKe's role as a dedicated actor for a coordinated implementation, the fact that smaller municipalities still struggle to utilize the system witness that the regional system propagation has been too asynchronous. It could thus seem that the appropriated strategy, where FUNNKe would delegate responsibilities to the municipalities after the system was installed, has failed to suffice. The sociotechnical context the system was to be implemented in should have been paid closer attention to and considered as an independent actor, with its own sets of specifications.

According to II theory, the original strategy of entrusting the implementation to a regional project, and completing the implementation within a relatively short time period (originally three years), is considered to be a wise strategy in order to create a large enough user-mass to make the system self-reinforcing. However, when isolating the communication between hospitals and municipalities, our informants did not experience the system as reliable for transfer of clinical information between health levels. As FUNNKe was assigned the regional responsibility for the EME system, and should have had the ability to identify unintended consequences, this could indicate that the implementation strategy had failed to include tactics to help deal with emerging consequences. We argue that an on-going, thorough evaluation during the implementation process could have supported the work of mapping unintended consequences and dealing with them.

The EME system introduced new standards of communication meant to support many different scenarios, ranging from exchange of pharmaceutical information, planning of hospital admission and discharge, as well as general follow-up for GPs. We argue that the current message exchange routines are not flexible enough to support all local work practices found in primary, and especially, specialist care. Nurses in specialised care expressed the need for more direct and synchronous communication in order to exchange valuable clinical information between health levels, which the EME system could not provide. This seems to have caused a problematic distance between the intended system use and the actual work routines. We believe that this mismatch between the systems intended use and the nature of existing work practices could have been identified if actual hospital users had been paid closer attention to during the creation of the system. A mapping of work practices could have identified the actual needs of the heterogeneous user group, thus cultivating the conditions needed to obtain a larger user-mass and supporting the systems initial growth. We have identified specific aspects that we believe could have contributed to this, such as closer follow-up and monitoring of smaller municipalities, a more thorough strategy for user education, and message notification in the hospitals EPR. However, the gap between intended use and work practices seems to wide to be bridged by these measures alone. The new communication routines did, however, fit well with the work practices of municipal nurses and GPs, and had in this case led to a more convenient workday for both actors. The fact that the system improved coordination

in settings where existing routines and intended use were more coinciding further strengthens this reasoning.

Healthcare work is of a complex and messy nature, and it is therefore impossible to predict what effects a new communication infrastructure will have on existing work practices and an organization as a whole. The big-scale regional distribution and implementation of the EME system involved nine separate hospitals and 87 municipalities. In addition, the municipality of Tromsø, like several others, had established a separate office to deal with the allocation of healthcare services for its inhabitants. The responsibility for message processing had thus been split between administrative workers and municipal nurses. This further increased the complexity, and led nurses to experience confusion towards whom they actually were communicating with. Establishing a new infrastructure for inter-organizational communication between such diverse and complex organizations will inevitably generate unintended consequences. The most prominent being that the emerging new routines complimented, rather then replaced, existing communication routines, creating additional work tasks for hospital users. This is coinciding with previous research on electronic messages from another region in Norway (67).

The 2012 White Paper "One inhabitant – One journal" state that "*Increased use of electronic messages will improve coordination*" (68, p. 52). We argue that the equation is more nuanced and complex. Increased use alone will not necessarily improve coordination of healthcare services. Our findings show that although the system is being used, direct clinical benefits do not automatically follow. For a proportional improvement in coordination, the messages have to be used in a way that supports the actual work practices. The argument that increased use equals improved results is the same that seems to have governed the whole implementation process, and fails to appreciate the complex nature of healthcare work. To actually improve the coordination of care, a thorough knowledge of work practices has to be the starting point of design and implementation for systems supporting this effort, an aspect that seems to have been neglected in the process so far.

It is not sufficient to base an evaluation of the system on the opinions of actors from only one level of the organization. It should rather be based on a collective,

continuous evaluation that involves several aspects like efficiency, user satisfaction, impact on work practices, and economy. It is obvious that there has been a lack of user perspectives in the evaluation of the EME system up to this point, and our thesis must be seen as a contribution towards a more comprehensive system evaluation. As the EME system is only one part of the national strategy to improve collaboration across health levels, we also believe aspects from this thesis could be taken into consideration when introducing systems of a similar kind. Based on our experiences, we recommend further efforts to make patient information readily available for all actors through a shared management and administration of data, regardless of localization.

7.1 Limitations and further research

It must be acknowledged that the biggest limitation in this thesis is posted by our novice experience as interpretive researchers. We recognize that our background and preconceptions could have influenced our findings and interpretations. We have strived to maintain transparency and a neutral position throughout out this thesis by following a theoretical framework and acclaimed principles for robust qualitative research. It is also possible that our empirical data would be different if the study were conducted at a later time and in a different setting. It only provides a snapshot into the complex and ever-changing reality of healthcare, thus only illustrating the current situation. This study has not considered the system's specifications, and how this might affect further development and change.

Provided that the goal of replacing the telephone and paper-based routines is continued, more research is needed to review and revise the EME system in order to facilitate actual needs of the users. Further research should be of a wider scope, and aim towards a more comprehensive understanding of how electronic messages are used, and how it entangles with the complex work practices they are supposed to support. The goal should be to identify factors and features that require attention, or change, in order to best facilitate efficient and high quality information exchange and coordination across organizational borders.

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9 Appendix

Appendix 1: Distribution of work

Following is an overview over the chapters in the study, stating who has contributed and to what degree.

Chapter		Main author	Supporting author
2	Theory	Kristian Berg	
3	Method	Kristian Nicolaisen	
4.1	Organization of the Norwegian Health Care system	Kristian Berg	Kristian Nicolaisen
4.2	IT in the Norwegian health care sector	Kristian Nicolaisen	Kristian Berg
4.3	FUNNKe	Kristian Nicolaisen	Kristian Berg
4.4	Technology and message types	Kristian Berg	Kristian Nicolaisen
4.5	National status for electronic message exchange	Kristian Berg	Kristian Nicolaisen
4.6	Prior research	Kristian Nicolaisen	Kristian Berg
5.1	User experiences of training and educational strategies	Kristian Nicolaisen	Kristian Berg
5.2	Connecting system features and work practices	Kristian Berg	Kristian Nicolaisen
5.3	Organization of clinical work and system use	Kristian Nicolaisen	Kristian Berg
5.4	Intended and unintended consequences affecting routines	Kristian Berg	Kristian Nicolaisen
5.5	Collaboration routines between the municipality and the hospital	Kristian Nicolaisen	Kristian Berg
5.6	Informal and formal communication in healthcare	Kristian Berg	Kristian Nicolaisen
6.1	Expanding the installed base with the EME system	Kristian Nicolaisen	Kristian Berg
6.2	System use in multiple contexts	Kristian Nicolaisen	Kristian Berg
6.3	Cooperation across complex settings	Kristian Berg	Kristian Nicolaisen

The Introduction and the Conclusion have been co-written with equally shared workload and is therefore not included in the above table. We have prior the writing divided the chapters up in different subjects, and split them between us. The chapters were then compiled, and we reviewed them plenary. By sharing the work this way, we feel like both authors have had the opportunity to provide input and opinions on the current subject. The joint reviews have also been crucial for maintaining the flow and context throughout the thesis.

Appendix 2: Interview guide

Hvem er vi?	**Masterstudent nå. Har jobbet 18 måneder i kommunehelsetjenesten/UNN.**
Hvorfor vil jeg intervjue deg?	Har jobbet med elektronisk meldingsutveksling som sykepleier selv, og sett både utfordringer og potensial. Ønsker å se på implementeringen og hvordan systemet fungerer blant de som bruker det mest; sykepleierne. Intervjuet skal brukes i vår masteroppgave som vi håper skal si noe om hva som skal til for å få et slikt system til å fungere slik det skal, og som igjen kan føre til at det blir lettere å innføre nye systemer i framtiden.
Innledende spørsmål	Navn? Alder? Utdanning? Stilling? Hvor lenge har du jobbet i kommunen/UNN?
Avdelingsrutiner	Pasientgrupper/grad av sykdom. Liggedøgn. Arbeidsbelastning. Arbeidsoppgaver.
Generell bruk av data i arbeidshverdagen	Datasystem i daglig bruk. Viktigheten av data i arbeidshverdag. Tanker rundt det å bruke DIPS/PROFIL.
Bruken av elektroniske meldinger	Hensikten med PLO/elektroniske meldinger. Elektroniske meldinger/PLO i arbeidshverdag. Hyppighet av bruk.
Brukervennlighet	Hvordan er det å bruke systemet? → Hvorfor er det enkelt? → Hvorfor er det vanskelig? Forståelse av alle funksjoner i systemet? → Hvis ja: hvorfor? (opplæring, intuitivt, selvlæring) → Hvis nei: hvorfor? (opplæring, intuitivt, selvlæring)
Opplæring	Opplæring i bruken av elektroniske meldinger. Behov for, og bruk av de publiserte retningslinjene for bruk. Ledelsens rolle/engasjement.

Bruk av meldingstyper	Hvordan meldingstype bruker du mest? Hvordan bruker dere: →Innleggelsesrapport(kommune)? →Forespørsler/svar på forespørsler? →Melding om utskrivningsklar pasient (UNN)? →Helseopplysning ved søknad(UNN)? Vet du hvor de ulike meldingene blir sendt?
Endringer i rutiner	Har elektroniske meldinger erstattet andre rutiner? Elektroniske meldinger/PLO bedre eller dårligere i forhold til andre kommunikasjonsformer?
Oppsummering	Oppfyller systemet sin hensikt? →Pasientflyt →Pasientsikkerhet Hvilke tiltak ville du satt i gang for å gjøre systemet bedre? Hvilke tiltak ville du satt i gang for å få folk til å bruke det bedre?
Avslutning	Har du andre innspill når det kommer til bruken av elektroniske meldinger i kommunen/UNN?