Vigdis Heimly

Electronic collaboration across organizational borders in the health care sector

Design and deployment from a national perspective

Thesis for the degree of Philosophiae Doctor

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Norwegian University of Science and Technology
Faculty of Information Technology, Mathematics
and Electrical Engineering
Department of Computer and Information Science

NTNU – Trondheim
Norwegian University of
Science and Technology

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Summary

The purpose of this thesis is to make a contribution to the improvement of electronic collaboration across organizational borders in the health care sector. I have studied this problem from a sociotechnical[1] point of view and have tried to find out what we can learn from the process and how lessons learned could potentially influence further development and deployment of collaboration systems at a national level. I have used electronic referrals as a case. Practice consultants are General Practitioners (GPs) who work in part-time positions at the hospital, and I have paid special attention to their potential role in collaboration projects. I have also discussed the need for electronic collaboration as a basis for the coming Coordination Reform (Samhandlingsreformen).

Research questions

My research questions are the following:

Q1 What is the status and what are the needs for electronic collaboration in the health sector in Norway?

Q2 How can practice consultants influence the development and deployment of electronic referrals?

Q3 How can general practitioners influence national ICT-strategy processes and national electronic collaboration projects?

Q4 How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

Methods

My work has been based on use of mixed methods, both qualitative and quantitative. I initially did a review to get an overview of large referral projects. I did a database search, and I also used national strategy documentation, action plans and project documentation as a basis for the review.

To supply the review data, I conducted a national survey of the development of electronic referrals in collaboration with the Directorate of Health and their project Meldingsløftet (The Message boost project).

Case studies

I have done four case studies:

1. Case study of the coordination reform and the role of electronic collaboration. A situation analysis of eight trajectories that span primary and secondary care was performed.

[1] Sociotechnical refers to the interrelatedness of *social* and *technical* aspects of an organization.

2. Case study of the specification and development of a Core EHR.
3. Case study of the GP's National Reference Group.
4. Case study of a hospital and six GP practices that were involved in the introduction of decision support in the referral process.

Information for the case studies has been gathered by:

- Observations though my participation in the projects.
- Semistructured individual interviews and group interviews.
- Reading of project documentation as minutes from meetings, reports and plans.
- Reading of national strategy documentation.

Main contributions

C1. Suggestions on how practice consultants can influence the development and deployment of electronic referrals (Q2)
Practice consultants should be involved in design of modules and systems that support the GP's work processes regarding electronic referrals. They should be considered for the role of pilot users in electronic referral projects and should be used in anchoring processes and take part in processes to make agreements about the content and structure of information that should be transferred.

C2. Suggestions on actions that national bodies can take to make more reliable plans for the development and deployment of ICT systems that support collaboration (Q1, Q3, Q4)
National bodies need longer strategic planning periods and should plan for more stepwise implementation of ICT systems than the practice is today. The Coordination Reform is not supported by necessary electronic collaboration solutions, and more attention should be paid to improve electronic collaboration systems from a national view. National projects need to be anchored at a local level and reference groups like the GPs' EHR reference group should be considered used. Decision support and booking are commonly used in other countries. There is a need for further development in Norway, but it was also hard to see quality improvements for the hospital from the decision support case in the thesis.

C3. Suggestions on how clinicians can influence national ICT-strategy processes and national electronic collaboration projects (Q3)
Experiences from national EHR reference group show that the group can be used to coordinate input from GPs to national authorities, vendors and national projects. National authorities should consider funding of the group.

C4. Suggestions on how the design and deployment of electronic collaborations in the health sector can be supported from a sociotechnical viewpoint (Q4)
The design and deployment of collaborative systems can benefit from the use of frameworks such as the Locales and Boundary frameworks to ensure that sociotechnical aspects are addressed. New functionality to support collaboration must be integrated into the GPs EHR systems. GPs and specialists may have a different view on, and different use of, information that is transferred (e.g., a discharge letter or referral). Common understanding and agreement are needed and the practice consultants can be used as mediators.

This thesis is based on the status and needs of the health care system in a Norwegian context. The results from my work are not necessarily transferable to other countries because many factors, such as the organization of the health sector, incentive models, legislation and the installed base of information systems, differ substantially between countries.

Preface

This thesis is being submitted to the Norwegian University of Science and Technology (NTNU) for partial fulfillment of the requirements for the degree of philosophiae doctor.

This doctoral work was performed at the Department of Computer and Information Science at NTNU with professor Eric Monteiro as the primary supervisor and Pieter Jelle Toissant (NTNU) and Jim Yang of the Norwegian Centre for Informatics in Health and Social Care (KITH) as co-supervisors.

This thesis is a contribution to the VERDIKT[2] project "Regional Communication", which was financed by the Research Council of Norway. Professor Gunnar Ellingsen from the University of Tromsø (UiTø) was the project manager. The aim of the VERDIKT project was to generate relevant knowledge of product and process innovation to support health service delivery across the value chain as well as to increase the efficiency and improve the quality of health care delivery to patients. Vendors, user organizations and researchers participated actively in the project. The vendor group included some of the largest actors in ICT in Norwegian health care (TietoEnator – tieto.no, Siemens – siemens.no, CGM – cgm.com and DIPS - dips.no). The user organizations included several university hospitals, and the research partners constitute a collaboration between UiTø and NTNU/NSEP.

This thesis includes work performed at St. Olavs Hospital, part of the Regional Health Authority (RHA) in mid-Norway and at the Akershus University Hospital (AHUS), part of the southeastern RHA. The Norwegian Centre for Informatics in Health and Social Care (KITH – kith.no) and the Directorate of Health were also important contributors to this work.

[2] The Research Programme on Core Competence and Value Creation in ICT (VERDIKT) (2005-2014) is one of the programmes developed under the Research Council's Large-scale Programme initiative.

Acknowledgments

I want to thank all of the people who have made this work possible. I would like to thank Jacob Hygen and Tom Christensen at KITH, who has been very kind and allowed me to have partial leave from my job. I am also grateful to have had the chance to utilize my experience from KITH in my PhD work. I would also like to thank Jacob Hygen at KITH for being my inspiring cowriter and project manager for the Cooperation reform study. Thanks to Kirsten Petersen from AHUS Hospital and the Directorate of Health, who has been my main contact person for the Interactive Referral Project at AHUS and the national project, Meldingsløftet. Thanks to professor Anders Grimsmo and professor Arild Faxvaag at the Norwegian Electronic Health Record Research Centre for allowing me to take part in the EHR monitor work. Thanks to MD and practice consultant Regin Hjertholm and the EHR reference group for providing me with more insight into the general practitioners' needs for tools to better support electronic collaboration. Thanks to the practice consultants, general practitioners and all of the members of the Interactive referral project group at AHUS. Thanks to Rut Naversen at St. Olavs Hospital and Bente Bredholdt at HEMIT for providing my main contact personnel in ongoing electronic collaboration projects associated with St. Olavs Hospital. Thanks to fellow student Ole Alsos for being an inspiration and support in helping me improve my presentations and illustrations. Thanks to Kai Dragland, my mother Dagny Heimly and my fellow students Ola Alsos, Anita Das, Kirsti Berntsen, Børge Lillebo for helping me with the photos from the NSEP utility lab. Thanks to Torstein Hjelle, Gro Alice Hamre and Anca Deak for sharing ideas and being patient and tolerant office mates and friends. Thanks to Jens Ellingsen at Siemens for serving as their contact person for the Regional Communication project. Thanks to Kirsti Berntsen for co-writing the paper about the Core EHR project together with me. Thanks to all of the students and supervisors from IDI who have participated in the research community Forskerfabrikken and who provided me with useful feedback on my papers. Thanks to my main supervisor, Eric Monteiro, for spending a large amount of time with me and for providing me with feedback on my work and co-writing one of the papers in the thesis. Thanks to the project manager, professor Gunnar Ellingsen, at the University of Tromsø, for giving me the opportunity to participate in the project and for sharing his experiences with other project team members. Thanks to my co-supervisors Pieter Jelle Toissant and Jim Yang for valuable input to my work. I also want to thank my family and friends and, specifically, my husband Øystein Nytrø.

Acronyms

ACCA	The Association of Charter Certified Accountants
AHUS	Akershus Universitets Sykehus (Akershus University Hospital)
CEN	Comité Européen de Normalization (European Committee for Standardization)
DC1..n	Data Collection activity, number 1..n
DIPS	Distribuert Informasjons og Pasientdatasystem i Sykehus (Distributed Information and Patientdata System in Hospitals)
EDI	Electronic Document Interchange
EHR	Electronic Health Record, electronic patient record (EPR) or computerized patient record
ELIN	Elektronisk Informasjonutveksling (Electronic Information Exchange)
GP	General practitioner
HA	Health Authority
HEMIT	Helse Midt-Norge IKT (Health Region Mid-Norway ICT)
HOSPA	Hospital A, fictive name for a Norwegian hospital
KITH	Kompetansesenter for IT I Helse- og Sosialsektoren (Norwegian Center for Informatics in Health and Social Care
MD	Medical doctor
NICT	Nasjonal IKT (National ICT)
NSEP	Norwegian EHR Research Centre
NTNU	University of Science and Technology
PCS	Patient care system
PKO	Praksiskonsulent (Practice consultant)
RHA	Regional Health Authority
VERDIKT	Kjernekompetanse og VERDiskaping i IKT (Core Competence and Value Creation in ICT)

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1. Introduction

1.1 My motivation for this thesis

I have worked in the field of health informatics for more than 20 years, and I started my career as a consultant in a large international company. In recent years, I have been connected with the Norwegian Centre for Informatics in Health and Social Care (KITH). This center is a national resource that works closely with actors such as the Directorate of Health, vendors and users. Some of KITH's work is related to standardization of electronic information exchange, EHR (Electronic Health Record) systems, and classification and coding systems, but we have also participated in many national development projects. I have worked on large projects such as the introduction of the first EHR systems for hospitals and the establishment of one of the first regional health nets in Norway. I have participated in national and international standardization within the field of health informatics. This work has given me insight into the processes of how to make the infrastructure, EHR systems and standards available to users and has also provided insight into the complicated interplay between new technology and users. I have especially been interested in how new technology can support or change work processes and how we can ensure that new collaboration systems will be used and deployed on a broad scale.

I have mainly used projects that I have a connection to from my work at KITH as a basis for this thesis, in addition to the VERDIKT project "Regional Communication". My position at KITH has provided me with insight into national projects and processes; however, I have also had the challenge of balancing my role as a KITH worker with my role as a researcher.
Because KITH accomplishes a substantial amount of work related to the development of standards, coding systems and classification, I have always been concerned with how to best support the users to obtain a system that supports their daily work processes and needs. One of my main interests over the years has been to investigate how we can scale smaller initiatives into larger initiatives that could be of interest to a broader national audience and that could also be of international interest.

1.2 Background

I present two examples of projects that I was involved in before I started working on my PhD: the EHR project and the collaboration project Orbit. They are not part of the PhD work. I have included them because they provide an important basis for my decision to start working on a PhD in this field. They have shaped my perspective on "sociotechnical" as I shall describe later in this chapter. The EHR project shows how one of the first EHR systems developed for hospitals in Norway was designed in close dialogue with the clinicians. The second project shows how general practitioners (GPs) designed a solution for collaboration between hospitals and GPs. In its second phase, this system depended on information that was registered in the hospital's EHR system that originated from the first project.

1.3 The EHR project

This project began in the early nineties when EHR use in hospitals was very limited.

I became involved in the project after my manager convinced me, at an early stage in the project, to become a project manager on behalf of three Norwegian University hospitals.

I was sent to Tromsø, where I met the medical doctor who initiated the project. My first meeting with him was rather shocking: he appeared to live in a small office that was totally filled with smoke. The only other things that I had heard about him before the meeting were rumours of his collection of artificial pigs. The pigs were not kept in his office, so I never had a chance to see them. They were said to be gifts from students and friends from the time he worked with surgery on pigs as research animals.

One of the main ideas behind the system was to develop a tool that could be used to define structure elements for each document type. The idea was that searches for structure elements across documents within the hospital could be set up, for example, to obtain a timeline for medication or to diagnose codes. It was also planned to extract structure elements from a set of documents to produce recommendations for discharge letters. This task could include information forms, admission notes, daily notes and surgery descriptions and would make the production of discharge letters faster than the existing practice where the MDs dictated a summary.

The pilot of the system was developed on a prototype basis. The prototype was enhanced and was presented at every meeting the secretaries and medical doctors (MDs). We never had detailed system specifications, but from the notes from each meeting with the users, high-level specifications were produced. A research and development (R&D) contract with a software vendor was established, and they started to develop a more robust pilot of the system that could be tested in the wards. I worked together with the users at the wards when the system was put into use. The MDs who took part in the work with the first pilot were resource personnel who were very visible at a local level. The system was installed at all three hospitals as a first version, but funding for the R&D project ran out, and it was very difficult to generate further funding, especially because another project in southern Norway also needed funding and was growing in size. At some point, it was decided to combine the two projects together so the project could be continued (Ellingsen and Monteiro 2003). The joint system has been further developed and is still in use at some large hospitals in Norway today.

1.4 The Orbit project

The Orbit project (KITH 2001) was a project developed in Orkdal in mid-Norway. This project included the manager of a medium-sized hospital, the manager of health and social services in a small municipality, an ICT manager from the county administration, the manager for KITH and two general practitioners. The initiative originally came from the GPs. I joined the project as an administrative project manager to support the GPs who were responsible for the clinical aspects of the project.

The aim of the project was to improve collaboration between the hospital, the nursing home in one of the municipalities and the GPs. GPs in 13 municipalities were involved in the project. The medical secretaries from the same practices were also involved. At the time when the project started in 1998, all of the GPs had implemented EHR systems. The hospital did not have an EHR system, so the discharge letter was written in a word processor by the secretary based on a dictation from the specialist. The GP obtained the discharge letter from the secretary and then marked all of the relevant parts of the discharge letter with a marker pen and handed it back to the secretary. The secretary would later type in the relevant sentences in the GP's EHR, so it would be easily accessible for upcoming consultations and follow-ups with the patient.

The GPs were the main drivers in the project, and they were very eager to extend the use of the ICT because they had seen the benefits of the introduction of the EHR in their own practices; namely, the EHR systems supported their daily work processes and, in reality, gave them more time for the patients or, perhaps more importantly, time to treat more patients (which is important when your income depends on the number of daily consultations). They wanted to reduce the number of paper transactions, but they were also very concerned with the quality of the discharge letters. The lines that they said they selected from the discharge letter were very few compared with all of the information that they received and did not really need. The structure and the length of the discharge letter also depended strongly on who had sent the letter. The GPs also told that some specialists wrote long discharge letters and copied most of the patient's record from the hospital stay into the discharge letter. Other specialists wrote discharge letters that appeared to be intended as a summary to obtain a quick overview of the patient's previous history if the patient was readmitted to the hospital, while others were very useful in aiding the GP when following up with a patient and when receiving the patient back in primary care.

As the project moved on, it was evident that the GPs' challenges not only were related to a lack of infrastructure and media for electronic collaboration but were also related to a lack of understanding of what content actually needed to be transferred. From my previous experiences with the EHR project, this scenario did not come as a large surprise. Much effort there was placed on "How do we make the production of discharge letters to be as efficient as possible?" The specialist simply did not appear to be aware of the GPs' challenges. The discharge letters were also sent from the hospital long after the patient was dismissed. In some cases, it could take as long as two weeks before the discharge letters arrived in the GP's office. Given that the patient (or nursing home or home care service) contacts the GP quickly after the patient had left the hospital, this delay was problematic. As an example, many actors outside of the hospital would need to know about changes in the patient's regular medication or treatments that the patient was given at the time of leaving the hospital.

The first draft of both a standard message from CEN/TC251[1] and a Norwegian draft existed at the time; however, with no EHR system present at the hospital, there was a need for a preliminary solution. It was decided that the discharge letter could be sent as a secure e-mail item from the hospital to the GPs for the pilot system. Electronic discharge letters were sent on a routine basis to five of the GPs by the time the projects ended. When the hospital later installed their first EHR system, the secure transfer of MS Word documents was replaced by standardized electronic

[1] CEN/TC 251 (CEN Technical Committee 251) is a workgroup within the European Union that is working on standardization in the field of Health Information and Communications Technology (ICT) in the European Union.

messaging. During the project period, all of the involved actors decided to connect to the secure Norwegian Health Net.

Practice consultants (PKOs) are GPs who work in part-time positions at a hospital. Their position is likely to be 10-20% of a full-time position. When the practice consultant is present at the hospital, he or she works with issues that are related to collaborations across organizational boundaries. Some examples of such activities are revisions of procedures for referrals from general practice to the hospital ward and collaboration with specialists at the hospital regarding the structure and use of documents that are communicated, e.g., discharge letters, referrals and laboratory reports.

The PKO system was initially an initiative from the GP Per Grinsted, who wanted to reduce the waiting times for patients receiving specialized treatment (Olesen, Jensen et al. 1998). The initiative gradually spread to other Nordic countries, and a Nordic collaboration forum was established in 1997. Odd Jarl Kvamme is a Norwegian GP who became interested in the Danish PKO system (Kvamme and Hjortdahl 1997; Kvamme, Eliasson et al. 1998; Kvamme, Olesen et al. 2001) and convinced the hospital at Stord to be the first Norwegian hospital to utilize this pilot system. Kvamme's work was a great inspiration for the Orbit project, and we decided to establish a PKO system at Orkdal hospital. Four GPs and one nurse from a nursing home were recruited as practice consultants in 20% positions at the hospital.

Some results from the PKOs' work on the Orbit project were the following:

- Development of criteria for the direct referral of orthopedic patients for day surgery
- Development and deployment of a common structure for discharge letters
- Initiation of a shared care project for diabetes patients
- Development of new guidelines for the shared care of dialysis patients
- Establishment of secondments for nurses working in both primary care facilities and in hospitals
- Establishment of secondments for the GPs at the hospital's outpatient clinic

The newsletter, Orbitnytt, written by the practice consultants, was distributed to all of the GPs in the 13 municipalities on a regular basis during the project period (see appendix 1)**.**

1.5 Towards a working definition of sociotechnical in an electronic collaboration context

The concept of sociotechnical systems emerged shortly after World War II at at Tavistock Institute in London (Mumford 2006). The Tavistock pioneers believed that their research projects should not only be attempts to increase knowledge, but that they should also embrace the improvement of work situations that were unsatisfactory in human terms. This meant that technology should not be allowed to be the controlling factor when new work systems were implemented.

Three salient aspects of my perspective – a working definition – on the notion of sociotechnical that emerge from my earlier experience are:

1. The interplay between users and technology
2. The different views of the collaborating actors
3. Regional and national perspectives

The interplay between users and technology

The experiences from working with the EHR pilot of the system were positive regarding support for the work processes. The iterations where the prototype was enhanced for every meeting with the users, gave them a possibility check that the system fit with their needs. The users at the hospital developed a strong sense of ownership to the product. On the other hand, we did not involve the actors in primary care (GPs and secretaries), and we did not consider which consequences changes in the production of discharge letters from the hospital could have for them.

In the Orbit project we did have a consensus about the information that needed to be exchanged, but we only had a simple technological solution: Secure email. This was later replaced by standardized electronic messages that were sent through the Norwegian health net. Still the recommendation for the content and structure of the discharge letter from the Orbit project could be reused, and the technology supported the work processes regardless of the technological solution.

The different views of the collaborating actors

The two projects illustrate how specialists in a hospital, GPs in primary care, administrative workers and consultants can have different views on the development and use of EHR systems and electronic collaboration. In the EHR example, the secretaries and specialists at the hospital were concerned about making a system that could support their work processes and about how they could also potentially automate the process of producing discharge letters. The structure of the discharge letters was suggested by the specialists in a consensus process in which specialists from several hospitals were involved. The GPs were considered to be receivers of information that was produced and were not truly considered to be collaboration partners. New technology made production of discharge letters more efficient, but did this really benefit the receivers?

When I worked together with the GPs in the Orbit project, I also experienced challenges from the GP's side. This time, the specialists at the hospital were reluctant to involve themselves much in the project, and there was a gap between the view of the GPs and the specialists. The first trials involving the use of practice consultants appeared to be promising for improving collaboration and were an inspiration for further work related to collaboration processes across organizational borders.

The regional and national perspectives

My later experiences from the Orbit project showed me that the EHR system at the hospital is also part of a much broader picture. The GPs depend highly on the quality and timeliness of the discharge letter, and a common understanding of how the basic standard should be used is essential in the collaboration process. My educational background and my past experiences in consulting have provided me with skills needed for working together with users in the design and development of hospital systems; however, at the time when I worked on the EHR project, I did not have sufficient knowledge regarding the secondary use of EHR information in primary care to involve GPs and adequately account for their needs. This consideration is likely still a challenge for many designers and system developers who are employed in organizations that collaborate with external actors. During the project period of the Orbit project, other similar projects were started in other parts of the country and a stronger regional and national coordination between these projects was also requested.

1.6 Research questions

My research questions are the following:

Q1 What is the status and what are the needs for electronic collaboration in the health sector in Norway?

Q2 How can practice consultants influence the development and deployment of electronic referrals?

Q3 How can general practitioners influence national ICT-strategy processes and national electronic collaboration projects?

Q4 How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

1.7 Methods

My work has been based on use of mixed methods including review, survey and case studies.

Review
I mainly used the database Scopus to search for relevant scientific papers, and I also backtracked to citations in the papers that I found in my searches (snowballing). I used combinations of terms, such as electronic referral, discharge letter, discharge summary, ehealth and review, as a basis for my search. I also used national strategy documentation, action plans and project documentation as a basis for the review.

Survey
I conducted a national survey of the development of electronic referrals in collaboration with the Directorate of Health and their project Meldingsløftet (The Message boost project). I also participated in three national project meetings in Meldingsløftet and presented my results from the survey with the participants.

Case studies
I have done four case studies:

1. Case study of the coordination reform and the role of electronic collaboration. A situation analysis of eight trajectories that span primary and secondary care was performed.
2. Case study of the specification and development of a Core EHR.
3. Case study of the GP's National Reference Group.
4. Case study of a hospital and six GP practices that were involved in the introduction of decision support in the referral process.

Information for the case studies has been gathered by:

- Observations though my participation in the projects.
- Semistructured individual interviews and group interviews.
- Reading of project documentation as minutes from meetings, reports and plans.
- Reading of national strategy documentation.

I have used different means to analyse my information. In case study 1 I made a table where I summarised the status of electronic collaboration for the actors that were involved in the eight trajectories. The table was validated by the reference group. In case study 2, I worked together with a project group with users, vendors and researchers from University of Science and Technology (NTNU)/the Norwegian EHR Research Centre (NSEP) who gave feedback continuous feedback on the work. In case study 3, I participated in the process of building a model for collaboration together with the GPs, and the model was evaluated by the group. In case 4, I transcribed the interviews. Text from the interviews and the field notes were coded thematically and analyzed in nVivo.

1.8 Summary of the papers

1. Electronic referrals in Health Care: A review, ***Medical Informatics Europe (MIE) 2009 (Heimly 2009)***

This paper provides an overview of large scale projects on the topic of electronic referral in health care. The first referral projects were based on standardized EDI communication. The same basis is still used in many projects, but these previous referral solutions are slowly being replaced by web-based solutions with the potential for enabling decision support and booking. The time from the initiation of the first services to high volume use appears to be strongly related to how well the new solutions align with the work practices of the general practitioners (GPs) and specialists and whether there are obvious benefits for the communication partners. High-volume national services appear to require both political support and pressure.

Relevance to this thesis
The paper was used to get an overview of the status of electronic collaboration in health care related to electronic referrals. Electronic referrals have been used as ex example of electronic collaboration in this thesis. The work is used as a basis to answer the status part of Q1: What are the status of and needs for electronic collaboration in the health care sector in Norway?

My contribution
I did the data collection DC1, and I was the main author of the paper.

2. The Norwegian Coordination Reform and the role of electronic collaboration*: Electronic Journal of Health Informatics, eJHI 2011 (Heimly and Hygen 2011)*

The Norwegian Government has identified electronic collaboration as an important tool for supporting an upcoming reform in Norwegian Health Care, which is called the Coordination Reform. The goal of this reform is to prevent citizens from becoming patients and to reduce the need for specialized care. The patients are also expected to become more active in taking responsibility for their own health. This paper summarizes the findings from a study that was performed to obtain an overview of the current status of electronic collaboration in the Norwegian health care sector and of the challenges resulting from a lack of such collaboration, which can in light of the coming reform. This work is based on input from a reference group, meetings with potential users and national strategy documents. A situation analysis of eight trajectories that span primary and secondary care was performed. The main results from the work are summarized in a collaboration map. The map shows areas that require more focus in the future development of collaborative ICT systems. The work shows that we lack ICT solutions that support shared care and that significantly empower the patient. This result is contradictory to the Coordination Reform's intention of empowering the patient.

Relevance to this thesis
The work is a used as a basis to answer the needs part of Q1: What are the status of and needs for electronic collaboration in the health care sector in Norway?

My contribution
This work (DC2) was conducted in collaboration with Jacob Hygen and Robert Landsem at KITH. Jacob Hygen is a coauthor of the paper. Jacob Hygen was the project manager. I did a substantial part of the analysis work, as to establish the collaboration map in table 1.

3. The Role of the Practice Consultant in Cross-Organizational Electronic Collaboration in the Health Sector, *IEE Computer-Based Medical Systems, CBMS 2010 (Heimly 2010b)*

This paper addresses how Practice Consultants can serve as boundary spanners to improve collaboration and knowledge sharing in the health care sector. Practice consultants are, in this paper, defined to be general practitioners (GPs) who work in part-time positions at hospitals with issues that are related to collaboration between primary care and specialized care. Practice consultants know the work processes in primary care well. Special attention is paid to how the practice consultant can play a role in the deployment of systems that support electronic collaboration across organizational borders. The electronic referral and discharge letters are used as examples of objects for which knowledge about the work processes in collaborating organizations is important for improvement of the quality of care according to the patient trajectory.

Relevance to this thesis
The work is a used as a basis to answer research Q2 and Q4:

- How can practice consultants influence the development and deployment of electronic referrals at a local level?
- How can general practitioners influence the national ICT strategy processes and the national electronic collaboration projects?

My contribution
I wrote the paper, which is based on my experiences from the Orbit project, where I was the administrative project manager (KITH 2001), and information gathered from my work with the Interactive referral project at AHUS (DC5) and the national survey (DC4).

4. The General Practitioner in the Giant's Web, *MIE 2011 (Heimly 2011)*

GPs in Norway use Electronic Health Record (EHR) systems to support their daily work processes. These systems were developed based on local needs. Electronic collaboration between the different actors has developed over time. Larger national projects such as the ePrescription and the Core EHR projects are examples of projects that interact with the GPs EHR systems. The requirements of these projects must be addressed by the vendors of the EHR systems. At the same time, the GPs see a need for the further development of their EHR systems to make them more suited to be tools to support daily work processes. This paper addresses how GPs can influence the design and development of their EHR systems in a situation that has a preexisting installed base of EHR-systems and an increasing number of requirements from many actors. The paper also proposes a model for the involvement of GPs in national processes.

Relevance to this thesis
The work is a used as a basis to answer Q3: How can general practitioners influence the national ICT strategy processes and the national electronic collaboration projects?

My contribution
I wrote the paper, which is based on my work together with the EHR reference group (DC6). I was project manager for the subproject "Kartleggingprosjektet" (KITH 2011).

5.* Clinical guidelines as decision support in the referral process in primary care*, IEEE International Conference on Information Reuse and Integration, IRI 2011 (Heimly and Nytro 2011)

This paper is based on a case (DC5) from a public health care system in which clinical guidelines were used as decision support tools for primary care to improve the quality of electronic referrals to a hospital. The guidelines were developed by the specialists at the hospital, but the design and development of the system were conducted in collaboration with general practitioners who work in primary care. This paper summarizes the findings from a study conducted six months after the introduction of the decision support system and is based on interviews with users in primary care. The work processes differed between the practices; general practitioners who wrote referrals after patients had left the office did not find the system to be as useful as the practitioners who wrote them when the patients were present. The general practitioners were reluctant to use the guidelines that implied an additional workload in terms of providing the hospital with more information than before, but they found the system to be useful as a support tool for ensuring that they made the correct clinical decisions. The guidelines were also seen as useful as a support tool for refusing to refer the patient to specialized care.

My contribution
I performed the data collection (DC5) and the main part of the analysis. Øystein Nytrø participated in the analysis and helped me to relate the work to other research activities. I was the main author of the paper, and assistant professor Øystein Nytrø was coauthor.

Relevance to this thesis
The work is a used as a basis to answer research question 4: How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

6. Consent-based access to core EHR information, Collaborative approaches in Norway, *Methods of Information in Medicine 2009 (Heimly 2008b)*

This paper summarizes the results of early work involving the development of the core EHR system in a Norwegian municipality. This paper is based on the experiences from the project; neither an evaluation of alternative solutions nor a review of international projects was part of this work. The core EHR system provides a generic basis that could be used as a pilot for a national patient summary. Examples of a wider use of the core EHR system include shared individual plans to support continuity of care; a summary of the patient's contacts with health providers in different organizations; and core EHR system information such as important diagnoses, allergies and contact information.
Extensive electronic cooperation and communication require that all of the partners adjust their documentation practices to align with the other actors' needs.

My contribution
I was the technical project manager for the core EHR project (DC3) and was the main author of this paper. Kirsti Berntsen was responsible for a related ethnographic study and was a coauthor.

Relevance to this thesis
The work is a used as a basis to answer Q4: How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

7. How can the Locales Framework be used as Basis for Design of Collaborative Systems in Shared Health Care? *IEEE International Conference on Collaboration Technologies and Systems*, *CTS 2010 (Heimly 2010a)*

This paper addresses both the increasing need for collaboration in the Norwegian health sector as well as how collaborative systems can be designed to facilitate the exchange and sharing of health information. An upcoming national health reform, the Coordination Reform, will focus on how patients can obtain health services in, or closer to, their homes. A change in the cooperation processes between primary and specialized care centers will trigger the need for better collaboration platforms. The design of electronic collaboration systems in health care has been challenging, and the deployment of existing systems has been slow. This paper addresses how the Locales Framework can be used to perform an analysis of the current situation and to provide a basis for the design of future collaborative systems. The framework appears to be adequate for the

analysis of collaboration processes in the health care sector and as a basis for establishing general recommendations for the design of collaborative systems.

My contribution
I wrote this paper, and it was based on data collection (DC1-DC6).

Relevance to this thesis
The work is a used as a basis to answer Q2 and Q4:

- How can practice consultants influence the development and deployment of electronic referrals at a local level?
- How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

8. Step by step, Climbing the stairs from the introduction of electronic health records to electronic collaboration, *Mediterranian Conference on Information Systems, MCIS 2011(Heimly and Monteiro 2011)*

The case in this paper is from a medium-sized hospital in Norway in which electronic collaboration related to referrals was introduced through a stepwise process. The first step was to introduce traditional electronic messaging. The next step was to implement decision support to improve the quality of the referral. The following step is planned to be a dialogue-based support system through which general practitioners and specialists can communicate about patients and in which the dialogue is retained as part of the patient's electronic health record. This paper summarizes the findings associated with the introduction of the decision support system. The results from the first steps are promising, but they also show that there is a sociotechnical interplay between the different actors that must be balanced to establish a solution that will be used by all of the actors.

My contribution
I wrote this paper in collaboration with Professor Eric Monteiro. This paper is based on my data collection activities during my PhD research (DC1-DC6).

Relevance to this thesis
The work is a used as a basis to answer research Q2 and Q4:

- How can practice consultants influence the development and deployment of electronic referrals at a local level?
- How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

1.9 Main contributions

The main contributions of my work are the following:

C1. Recommendations on how practice consultants can influence the development and deployment of electronic referrals (Q2):

- Practice consultants should be involved in design of modules and systems that support the GP's work processes regarding electronic referrals.
- Practice consultants should be considered for the role of pilot users in electronic referral projects
- Practice consultants should be used in anchoring processes and take part in processes to make agreements about the content and structure of information that should be transferred.

C2. Recommendations on actions that national bodies can take to make more reliable plans for the development and deployment of ICT systems that support collaboration (Q1, Q3, Q4):

- Electronic patient collaboration is limited in Norway and should be improved.
- Changes in work processes and tasks should be grounded by involved actors.
- The Coordination Reform is not supported by necessary electronic collaboration solutions, which should be improved.
- A national EHR reference group for GPs can be used as a resource for national activities (e.g., strategy work, national projects, hearings)
- National authorities should consider funding for the national EHR reference group
- Decision support and booking are commonly used in other countries. There is a need for further development in Norway, but it was also hard to see quality improvements for the hospital from the decision support case in the thesis.

C3. Recommendations on how clinicians can influence national ICT-strategy processes and national electronic collaboration projects (Q3):

- A national EHR reference group can be used as a resource group in regional processes
- A national EHR reference group can be used by vendors as support for maintenance and further development of EHR and collaboration systems
- A national reference group can possibly be used as a resource group for research on EHR and collaboration systems
- A national reference group can be used by the GPs as a coordinator for input to national authorities, vendors and national projects.

C4. Suggestions on how the design and deployment of electronic collaborations in the health sector can be supported from a sociotechnical viewpoint (Q4)

- GPs require that new functionality to support collaboration must be integrated into their EHR systems.

- The design and deployment of collaborative systems can benefit from the use of frameworks such as the Locales and Boundary frameworks to ensure that sociotechnical aspects are addressed.
- The stepwise introduction of new functionality in electronic collaboration appears to be feasible.
- GPs and specialists may have a different view on, and different use of, information that is transferred (e.g., a discharge letter or referral). Common understanding and agreement are needed and the practice consultants can be used as mediators.

2. ICT in health care: historical and comparative overview

2.1 Health care in Norway

The Norwegian health care system is mainly public. A major health care reform in 2001 led to the organization of the Norwegian hospitals under four Regional Health Authorities (RHAs) that are owned and supervised by the government. Primary care is the responsibility of the 430 municipalities in Norway. General Practitioners (GPs) work in private enterprises, but they have an agreement with their local municipality. This scenario implies that the different actors who are supposed to participate in health care across organizational borders are financed and managed by different sources.

All of the citizens in Norway are assigned to **one** GP's patient list, and the GP acts as a gatekeeper to specialized care. When the patient has finished treatment in specialized care, the normal procedure would be to return to primary care under the GP's responsibility.

The Norwegian health care system has obvious challenges that are also visible in other European countries with a public health system. The hospital administration wants to keep the patient stay as short as possible to reduce hospital costs, but this goal is associated with many challenges:

- Patients who have finished the required specialized care at the hospital and who are waiting for transfer to nursing homes, or who are not well enough yet to move to their own homes, are filling up hospital beds.
- As people live longer because of improved health care services, an increasing number of patients will need care when they are elderly.
- Many people are also rescued from sudden death, such as early newborns or people in traffic accidents, but they may require specialized care for a long period of time.

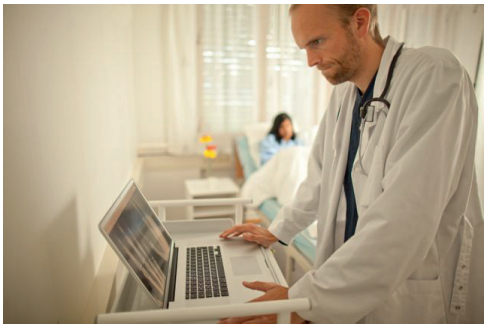

Figure 1: Patient in hospital, photo: Kai Dragland

A new Norwegian health reform, namely the Coordination Reform, is being implemented in 2011/2012 (Helsedepartementet 2009). This reform focuses on how the patients can be provided with more health care services in the primary care sector, which is closer to their homes, and on how to reduce the need for expensive specialized care. Economic incentives are an integral part of the Coordination Reform. Government funding will, to some extent, be channeled from the hospitals to the municipalities. The municipalities will then have to pay the hospitals according to the number of patients they refer to specialized care, and there will also be a high cost associated with paying for patients who have finished their hospital treatment but who occupy hospital beds until the municipalities are ready to receive them.

2.2 ICT in health care and national plans

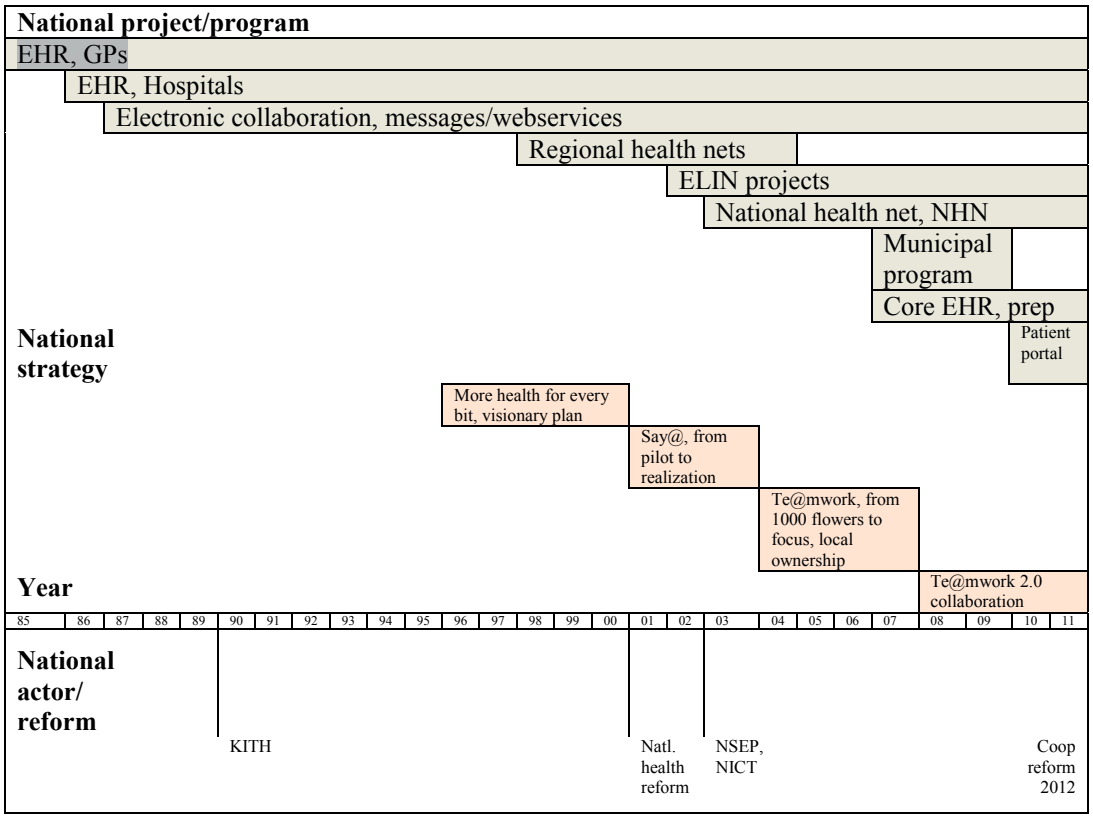

Figure 2: The development of ICT in Norwegian health care and its relation to national strategies

One of the goals of the health reform is that electronic collaboration will be a preferred future means of collaboration in the health care sector. This goal includes implementation of the following items:

- Electronic collaboration between the service provider and the patient/user; examples of such collaborative systems include electronic booking, on-line consultations/telemedicine and access to the EHR.
- Electronic collaboration between all groups of health workers across organizational borders.

Figure 2 illustrates the relationships between national strategy documents, national reforms, national strategic projects in health care and the establishment of national organizations related to ICT in health care. Norway has had four national strategic plans for eHealth. The first plan was "More health for every bit" (Helsedirektoratet 1996). This plan was visionary, with many suggestions for tasks that needed to be accomplished, but there was hardly any funding available for its realization. New pilots were initiated in which there was some possibility of raising

funding, but there was no coordination of the projects, and there were seldom possibilities for further development and deployment.

The next plan, Si@! (Helsedirektoratet 2001), focused on the realization of initiated pilots, electronic communication within the health and social sectors, telemedicine, a national health net and access to public information. The first plan had also given rise to many pilot projects, but one of the challenges was how to get from the pilot to the realization of the project. The establishment of the Norwegian Health Net was one of the pillars of the second plan. Secure, closed, broadband networks had been established in the health region in the north and in the health region in mid-Norway, and the experiences from these projects were used as a basis for further work. The network in northern Norway had mainly been used for communication between primary care and secondary care, with electronic message exchange as one of the main services. The health net in mid-Norway had focused mainly on traffic between hospitals, such as access to the PACS and EHR systems. It was not juridically accepted to share clinical data, but servers were moved to one location, and daily maintenance and operation costs were significantly reduced.

The plan for 2004-2007, Te@mwork 2007, had a dual focus (Helsedirektoratet 2006). The first focus was on improving the information flow between the parties who had already started to use electronic cooperation. This scenario included efforts to ensure the operation of the Norwegian Health Net; further efforts in terminology, coding, and classification; implementation of a digital signature/PKI (public key infrastructure); and a more extensive implementation of the EHR system. The second focus of the plan was related to the introduction of new partners in the electronic collaboration. Nursing homes and rehabilitation units were examples of such actors. The main partners in electronic collaboration had thus far been hospitals, GPs, laboratories, radiology services and the National Insurance Scheme. Municipal health services were included only to a very limited degree. The municipalities vary substantially in size and competence regarding the use of ICT in health care. A national program for the health-related use of ICT was introduced to support the municipalities, and five municipal pilot projects were established. The Te@mwork plan was also part of the eNorway plan and the goals and strategies that were set by the government.

There was also a shift from letting “1000 flowers grow” toward more coordination of the projects and a push from the Directorate of Health toward requirements for strong local ownership in projects that were financially supported. The municipal program was initiated to allow some municipalities to develop pilot programs that could act as models for further deployment to other municipalities. Examples of such projects were the Core EHR project for medication in Trondheim (Heimly 2008b) and a project for collaboration between nursing homes and hospitals in northern Norway. The first national that involved strong user management, ELIN (the electronic information exchange project), was initiated by the Directorate of Health in collaboration with the Norwegian Medical Association in 2002 (Christensen 2009). Based on the positive experiences from ELIN, an ELIN-k project with project management conducted by the Norwegian Nursing Association was initiated in 2006.

Te@mwork 2.0 (Helsedirektoratet 2008) is the current and fourth national strategy for electronic collaboration in the health and social sector. The main pillars upon which this plan is based are the following:

- Deployment and consolidation (less visionary goals)
- Strong leadership
- Strong local anchoring

The intention is that patients and users of health care and social services shall be included, both by providing information services and by electronic cooperation in areas such as medical advice, prescription renewal, and appointment scheduling. One objective is to support patients and users in taking more responsibility for themselves, and in utilizing their insights into their own condition to improve the care process.

The plan also includes specific sectors and applications in which developments have been modest, such as e-prescriptions.

2.3 The relation between the national plans and the work by national ICT

The RHAs have established their own ICT organization, named National ICT. National ICT is the arena for the steering and coordination of ICT-related activities in specialized care. They develop semiannual strategy plans and annual action plans. Their strategy work is closely linked with the national ICT plans that are developed by the Directorate of Health. One of their main goals is to make ICT a tool for more effective health services. This scenario should hopefully also result in more time spent with patients. Examples of expected outcomes of their ICT plans are improved routines, more automation and easier access to information. National ICT mainly provides funding for ICT-related tasks that are of common interest for the hospitals.

After the health reform in 2001, specialized care has increased their influence on ICT development in the health sector. Bid for tender processes for new ICT system in specialized care are initiated at the RHA level, and there is less room for local initiatives at a hospital level than before. National ICT has also set requirements that strongly influence the collaboration with external actors. As an example, HL7 has been used for a long time in relation to internally exchanged electronic information in specialized care. National ICT now wants to use HL7 for external communication because this makes their tasks easier.

2.4 Deployment of ICT in Norwegian health and social care

ICT has been used as a tool to support the Norwegian clinician's work processes for more than two decades. The first EHR systems were used by general practitioners (GPs) as early as 1984 (Hasvold 1984), when the Balsfjord system was installed. This project was a result of collaboration between the GPs in a local practice in a village in northern Norway and researchers at the University of Tromsø.

The development followed these principles:

- The system should support the GPs' work processes and should be adapted to the GPs' needs.
- Any economic benefit from the use of the new system should be used to improve patient services, and there should be no reduction in the number of health care workers.
- The development of the system should be financed by research grants and government funding. There should be no future vendor bindings.

The implementation was successful, but the system only had a limited number of users in northern Norway. The development of the Balsfjord system was nationally financed by research grants and government funding. The development of other EHR system for use in general practice followed the same principles, but the GPs outside the Balsfjord project did not receive any subsidies or incentives from the government when the new EHR systems were introduced. They had to buy the systems themselves, but they found the new systems to be so useful that they were worth the investment. Altogether, 98% of the Norwegian GPs have had these systems in daily use since 2008 (Helsedirektoratet-NSEP 2009) .

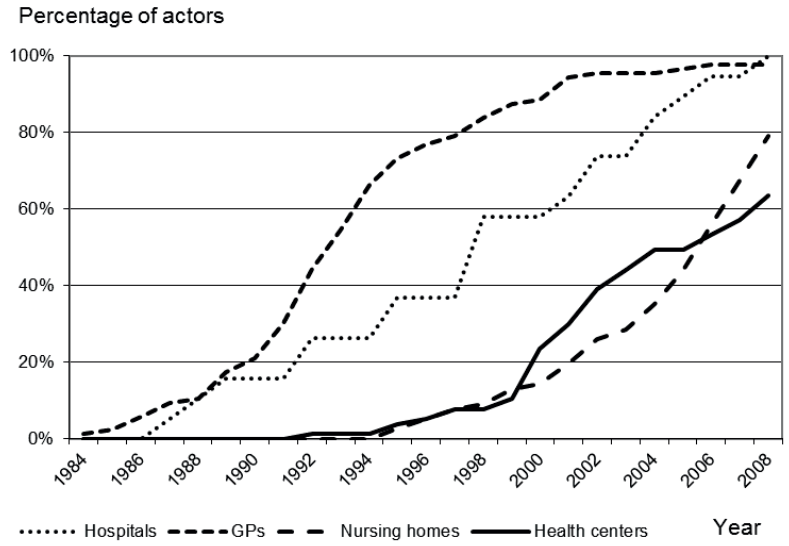

Figure 3: The accumulative percentage of different actors that either had implemented or were in the process of implementing the first EHR system between 1984 and 2008, (Helsedirektoratet-NSEP 2009)

As figure 3 from the EHR-monitor report (Helsedirektoratet-NSEP 2009) illustrates, EHR systems have been in use in all Norwegian hospitals since 2008. The monitoring of EHR system use shows that the diffusion curve is steady and that Norway has reached full coverage and use of EHR systems in both hospitals and GP clinics. The systems not only are implemented but are also used by the clinicians. The number of EHR system vendors is limited to 2-4 vendors in each system group (namely, GPs, municipalities, and hospitals). In addition to the traditional EHR system, the

hospitals have specialized systems that are used by the different specialists or administrative staff. The larger Norwegian hospitals will typically have 50-150 of these systems. Examples of such systems are laboratory systems, PACS, medical charts, operation planning systems, maternity ward systems and intensive care systems.

The EHR monitor project (Helsedirektoratet-NSEP 2009; Heimly V 2011) shows that the diffusion of EHR systems in general has been much slower than expected in GP practices, hospitals and community care centers. EHR systems in community care centers follow the same curve but are years behind the hospital curve. The diffusion of the collaboration systems is also slow and is linked to the diffusion of the EHR systems.

Electronic collaboration between caretakers in different organizations has thus far mainly been based on electronic messaging, but web-based solutions and systems that provide access to shared core medical information are also in limited use. Deployment of electronic messaging is of high priority according to the national eHealth strategy, but it has been much slower than expected based on the first national strategy plans.

Data regarding clinicians' use of EHR systems in Norway have been gathered and analyzed at hospitals (Lærum, Ellingsen et al. 2001) and at the primary care level (Christensen 2009). Deployment processes have usually been slower than expected based on national plans such as Te@mwork and S@mspill.

In his doctoral thesis, Christensen (Christensen 2009) analyzed how GPs use EHR systems and how they can be developed further to support GPs' work processes. Christensen concluded that a GP balances time spent examining and talking with patients; thus, the time spent on documentation is crucial. The GPs reported that they generally believe that using the computer saves time, and observations showed that they used even less time than reported in front of the computer. On the other hand, they also stated that the introduction of EHR had transferred the workload from the secretary to the GP. They were, in general, satisfied with their system, but they missed the possibility of decision support and communication with other systems, even if possibilities for message exchange had been made available in their systems. The clinician-patient relationship is of great concern in clinical practice for GPs, but they denied that the use of the computer takes their focus away from the patient. On the other hand, they stated that it had become more difficult to obtain an overview of a patient's previous health history.

The diffusion of EHR systems in hospitals has been much slower than in primary care, as illustrated in figure 3. Ellingsen and Monteiro (Ellingsen and Monteiro 2003) also stated that establishing EPRs in hospitals, especially large hospitals, had been difficult. They claim that the increase in organizational, institutional, political and technological complexity was seriously underestimated during the first years. Before the introduction of EHR systems in hospitals, patient administrative systems had been available in hospitals for a decade. These systems were mainly used for administrative purposes and kept track of demographic information related to the patient, the length of the hospital stay and the patient's diagnosis. This information is used as a basis for national statistics and funding of the hospitals by the government. The systems provided obvious benefits to the hospitals, as seen from an administrative point of view. The benefits have not been as visible when it comes to health record systems that can support the clinician's daily work processes. The clinicians in the hospital move over long distances during their workday and use

EHR systems only a few minutes at a time. Kawamoto et al. also showed that information resources must be easily accessible in the clinicians' workspaces for them to be used (Kawamoto, Houlihan et al. 2005). In the EHR monitor survey (Helsedirektoratet-NSEP 2009), 80-90% of the hospitals agree that there are large potential quantitative and qualitative benefits related to the introduction of EHR systems, but only 20-30% agree that these benefits have already been achieved. It is typical for there to be a time lag between the introduction of ICT systems and the time at which benefits can be achieved, but it is surprising that the survey showed that less than 50% of the hospitals had a plan for the realization of benefits related to the introduction of new systems.

Three major EHR systems are in use in Norwegian hospitals today. One vendor has a significantly larger market share than the others. This vendor's system originated from a small Norwegian hospital, and the first version was developed in close collaboration with users at the hospital. This scenario contributed to the development of a system that, to a high degree, supported the health worker's daily work processes. Although the system was originally designed to support a limited number of users, it is now in use at many hospitals, both large and small. This broad user base can be a challenge when it comes to user involvement in the design process and ensuring sufficient flexibility to satisfy diverse requirements.

2.5 Deployment of ICT in health care in other countries

Many studies regarding the diffusion of EHR systems have been based on cross-sectional data (Lærum, Ellingsen et al. 2001; Ellingsen and Monteiro 2003; Protti 2007; Protti, Edworthy et al. 2007; Protti, Bowden et al. 2008; Castro 2009). Other studies have investigated attitudes among health personnel and the characteristics of organizations and services, focusing on barriers to system adoption (Bower, Health et al. 2005; Stroetmann, Jones et al. 2007). These studies have generally not been longitudinal, although an important exception is Denmark, where diffusion has been followed continuously from 2000 to 2009 (Nøhr, Kristensen et al. 2001; Nohr, Andersen et al. 2005; Nøhr, Andersen et al. 2007) by the EHR-Observatory.

In many European countries, new initiatives regarding summary or core EHR systems, such as the Summary Care Record (SCR) (Greenhalgh, Wood et al. 2008; Greenhalgh, Stramer et al. 2010), are being developed. Patients can access the SCR via the Health Space portal. Other examples of such projects are the Nationell Pasientöversikt (Sweden), Mit Sundhedsoverblik and National Pasientideks (Denmark), Kansallinen Terveysarkisto (KanTa) (Finland), Emergency Care Summary (ECS) (Scotland), Electronic Medication Record (EMD) and Electronic General Practitioner's Record (WHD) (Netherlands). These systems can be accessed and/or maintained in a cross-disciplinary fashion. Additionally, a more patient-centered focus can be seen in some countries. To date, the implementation and deployment of these systems have been limited, and a stepwise introduction has been used. Legislation can also be a challenge, and patient consent might be necessary in many countries. There are also large European projects such as epSOS (Lindén 2009; Naqvi, Dallons et al. 2010; Thorp 2010) and Calliope (www.calliope-network.eu) that are intended to support interoperability across country borders. epSOS is a European electronic health interoperability project that focuses on improving medical treatment for citizens while they are abroad by providing health professionals with the necessary patient data. Calliope stands for "CALL for InterOPErability"; it has a focus on eHealth and is a thematic eHealth Network.

The USA has had a slow adoption of EHR systems (Lave and Wenger 1991). In 2008, Jha et al. (Jha, DesRoches et al. 2009) found that 1.5% of U.S. hospitals had a comprehensive electronic records system that was implemented across all major clinical units. Furthermore, he found that an additional 7.6% had a basic system that included functionalities for physicians' notes and nursing assessments in at least one clinical unit. When defined without the requirement for clinical notes, a basic electronic records system was found to be present in 10.9% of the U.S. hospitals. Castro (Castro 2009) considered challenges that the U.S. faced in the development of their electronic records system compared with those faced by European countries, such as Sweden, Finland and Denmark, in the development of ICT, and he identified potential lessons that could be learned. He noted that few factors, more governmental control and the use of incentives are possible drivers in the most successful countries. Gans et al. (Gans, Kralewski et al. 2005) also considered the adoption of EHR in American primary care and concluded that the smaller group practices appear to struggle: "The process of choosing and implementing an EHR appears to be more complex and varied than we expected." Protti et al. (Protti 2007; Protti, Edworthy et al. 2007; Protti, Bowden et al. 2008) found that "No single factor or simple combination was responsible for IT uptake and EHR adoption across all ten countries. Government health policies, though not always directly related to IT, appear to play important roles along with the presence of some single unifying authority. Size, nomenclatures and communications standards were significant additional promoters".

2.6 Integration challenges

Norway has already been very successful in the deployment of many ICT systems in health care, as illustrated in figure 3. That success has provided Norway with a large number of installed systems that are not easy to change. The systems come from many vendors, many of whom are located on isolated islands. New ICT systems that are developed in Norway are not greenfield projects; instead, they must be integrated with the preexisting installed base of systems. This task is challenging both with respect to the development of new modules and with respect to electronic collaboration.

Bygstad et al. (Bygstad, Nielsen et al. 2010) described a framework with four integration patterns that can be used based on a sociotechnical approach to integration in IS development projects. They found that patterns were context-sensitive, and they also described the different contexts in which the patterns are applicable. The patterns were: stakeholder integration, technical integration and socio-technical integration. These patterns represent a tool with which to analyze some of the risks of integration and to assess the managerial trade-offs. Examples from other countries show that the degree of success of such projects can vary from country to country and from context to context. As an example, stepwise integration lowers the implementation risk but greatly increases the complexity of the project.

Ellingsen et al. (Ellingsen and Røed 2010) and Hanseth et al. (Hanseth and Aanestad 2003) also provided models for how the integration of information systems can be performed in a preexisting information infrastructure in health care and how a modular approach can be used for the development of a new system.

2.7 Standardization as a basis for collaboration

Standardization has been used as an approach for providing a common basis for communication across organizational borders in health care in Norway since the early nineties. Standardization has not always been seen as a sought-after approach because many actors find that adjusting their systems to conform to certain standards is time-consuming and limiting. In addition, standards can take longer than expected to be developed, and projects can be delayed.

Sometimes actors want to develop a basis for new standards themselves and do not see the need for building a consensus. On the other hand, Norway has had a tradition of "letting a thousand flowers grow". This approach has resulted in the initiation of many pilot projects at a high cost. A common saying has been that "Norwegian health care has more pilots than the largest airlines in Europe." Funding for pilots has been provided by sources such as the Høykom program, Innovation Norway or the Directorate of Health, but there has been limited funding for deployment. As an example, Høykom provided funding for 49 projects within the health and social care sectors during the period from 1999-2007. An evaluation of the Høykom program (Statskonsult 2007) concluded that many of the projects were too small, and more focus was needed on coordination and standardization.

Today, the situation is that vendors and buyers want to use standards. It is more a question of which standards should be used: Should we adopt only international standards, or do we need to make national standards? How shall we apply them? How flexible should they be? The standardization work is linked to international standardization, and international standards are used as a basis for the development of standards when they coincide with Norwegian needs. The basis for the current Norwegian standardization work is that national standards are developed based on local needs and in collaboration with the vendors' end pilot projects. Examples include the ELIN projects (Christensen 2009), which have been managed by organizations such as the Norwegian Medical Association (ELIN-a project) and the Norwegian Nursing Association (ELIN-k project).

This approach has been a part of a strategy in which the Norwegian Government has encouraged unions, municipalities and RHAs to establish projects with local project management and in which a very limited number of incentives have been used to encourage the use of standards.

2.8 Electronic collaboration in health care

As shown in the previous chapter, Norway has developed a solid base of EHR systems. These systems are in daily use by clinicians, but the possibilities for electronic collaboration from the workstations are still limited. Messages such as electronic discharge letters and laboratory reports are in everyday use, but the clinicians are still complaining about deficiencies in the established systems in parallel with ongoing work on new systems.

The goal of this thesis has been to look more closely into the question of which collaboration systems we need in Norwegian health care and how the deployment of these systems can best be performed.

Figure 4: Trajectory for specialized patient care[2]

Figure 4 illustrates the trajectory of patient care from when the patient contacts the GP until the patient is back in home care after a hospital stay. During this process, essential information should be communicated between the involved actors in health care.

This scenario can include the following:

[2] Figure by Vigdis Heimly, photos by Kai Dragland

- Referral from the GP to a specialist
- A confirmation from the specialist to the patient regarding appointments
- Laboratory requisitions and reports
- Information regarding the patient's medication and changes in medication
- Request for home care services
- Discharge letter from the hospital to the GP and home care staff
- Report from nurses at the hospital to nurses affiliated with home care

This work considers electronic collaboration in general, but electronic referrals are used as a special case. The reason for this is that the electronic referrals so far have been deployed slowly, although the potential volume of electronic referrals that may be exchanged is very high. A KITH-report from 2002 (KITH 2002) stated that Norwegian GPs annually send 1.9 million referrals to specialists or hospitals. The patient flow in Norwegian health care depends strongly on the referrals. It is, therefore, important that the referrals can be written, transferred and handled efficiently.

2.9 Electronic referrals outside of Norway

Paper 1 (P1) (Heimly 2009) provides an overview of electronic referral projects in 2009. When electronic referrals were introduced, many individuals were hopeful regarding potential economic savings and user benefits. Examples are of studies in which potential economic savings have been anticipated and were conducted by Hasman et al. (Hasman, Ament et al. 1992), Hysong (Hysong SJ 2011) and Harno et al. (Harno, Paavola et al. 2000). One of the first referral projects started at Helsinki University Hospital as early as 1991 (Wootton, Harno et al. 2003). Another initiative came from the Danish company MedCom in Vejle in Fyn County in Denmark (Cannaby, Westscott et al. 2004; Pedersen and Wanscher 2005). Denmark appears to have been successful with projects such as the electronic health and message exchange, the referral hotel (Medcom 2008) and the portal Sundhed.dk (Endsley, Kirkegaard et al. 2005), while other projects such as EHR in major hospitals have, in essence, failed (Clarke A 2010), (Dixon A 2010). Two other Finnish projects were established early: one of them was a system for developed countries (Wootton, Youngberry et al. 2005), and the other was in the Oulo region (Reponen, Marttila et al. 2004). A lack of availability of a common infrastructure, missing implementations of standards by the vendors and shortcomings in the EHR systems were early technical factors that limited the possibilities for collaboration; however, even if the technical solutions were available, there appears to be a long path to full deployment, as seen in Norway (Heimly 2008a).

In a study by Medcom and ACCA (Cannaby, Westscott et al. 2004) , it was suggested that a widespread adoption of electronic patient referrals would result in significant cost savings for the Danish health care economy. Potential savings of €1,893,291 in direct costs per year were estimated. If society costs were included, this figure was estimated to potentially increase to €3,236,317 per year.

Figure 5 shows the development in the deployment of electronic messages in Denmark from 1992 to 2011 (medcom.dk). This figure shows that the number of referrals sent (the lowest blue curve)

is increasing steadily over a period of 11 years, but not as fast as the increase in the number of laboratory requisitions.

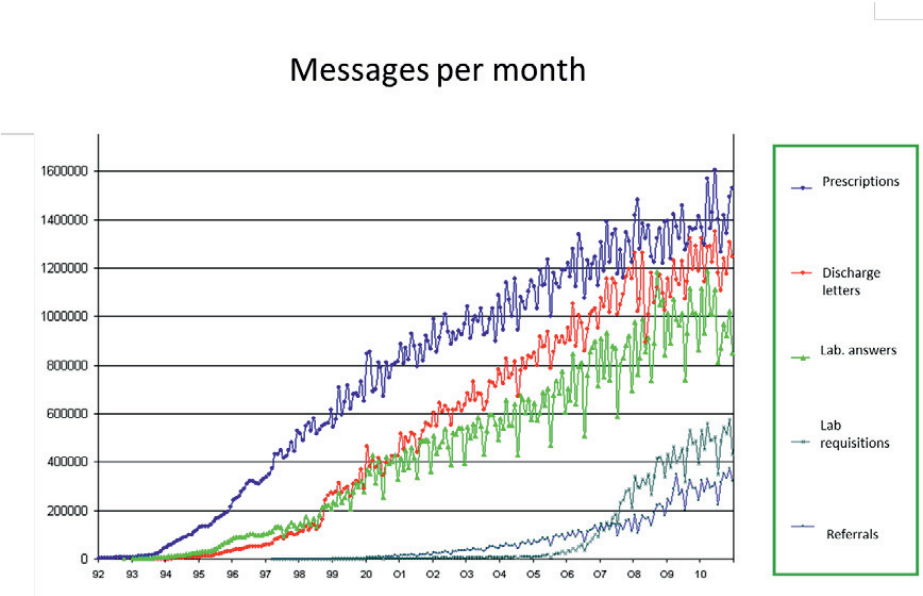

Figure 5: Medcom, message volume from www.medcom.dk

Newer projects of national interest are the following: the Danish Referral Hotel (Medcom 2008), the Choose and Book system in England (Eason 2007), and ZorgDomein (Bal, Mastboom et al. 2007) in the Netherlands. These systems have been started not only for the purpose of increasing the referral volume but also for the purpose of providing the patient with options for the choice of specialist and for improving the referral quality. The intention of Choose and Book was also to reduce the number of patients who did not attend (DNA) their hospital appointments. The number of referrals that are added to the referral hotel per month from 2008 to 2010 is shown in figure 6 (from www.medcom.dk). The figure illustrates a steadily increase in volume.

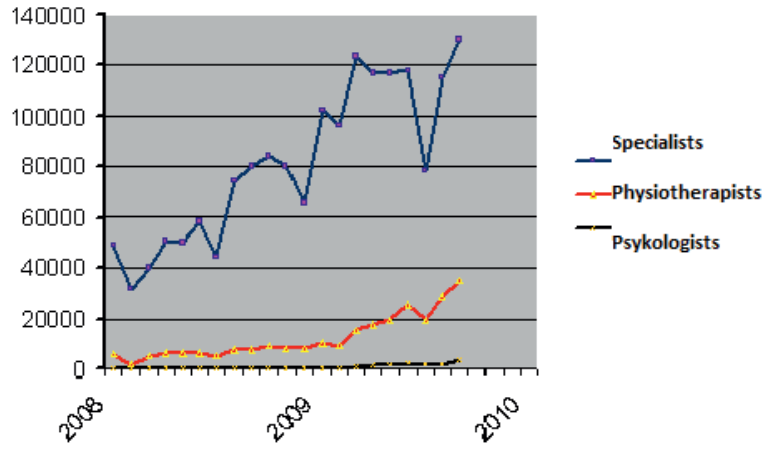

Figure 6: Referrals per month in the Referral hotel (REFHOST), Denmark (from www.medcom.dk).

Dixon, Ruthledge and Bal (Dixon A 2010) performed a recent comparison of referral projects in the UK (Choose and Book) and in the Netherlands (Zorg Domain). Choose and Book has been implemented as a part of the National Program for IT, which is managed by the Department of Health. Almost all of the GPs in England had Choose and Book available in 2005, but only 8% of the GPs used the system in January 2006. Less than half of the referrals for the first outpatient visit were sent electronically from the GPs in 2007-2008. The Department of Health's target was that 90% of these referrals should be sent electronically by March 2007 (DepartmentOfHealth 2006).

Zorg Domain started as a regional system and was available in 2010 in thirteen hospitals in a total of nine regions. Three hospitals with four hospital sites participated in the first part of the project. The basic goals were to implement a system to enable a smoother communication process between GPs and hospitals, to improve the quality of referrals and to improve the efficiency in the hospitals. Zorg Domain offers the GPs support for the referral process and combines several elements, such as referral protocols (which are based on existing national guidelines as well as local working routines), which have been standardized in medical specialist/GP consensus meetings, are up-to-date and/or guarantee access times for specialist consultations and patient information. GPs can choose which hospital they want to send a referral to. The format for the referral letter is standardized for each of the patient groups (agreed on in GP/medical specialist consensus meetings prior to implementation and based on existing national and regional standards). Ideally, the letter automatically extracts the relevant information from the GP's information system. The discharge letters from medical specialists to GPs have also been provided with standardized formats. Bal et al. (Bal and Mastboom 2007; Bal, Mastboom et al. 2007) studied the combined introduction of Zorg Domein and standardized care trajectories. They concluded that "the project itself furthers the integration of primary and specialized care. It does so, however, not through its technical applications, but rather through its formation of a new shared object that allows for the further development of ideals of integrated care".

After an initial period of difficulty, Zorg Domain appears to be successful. The number of referrals sent through the system is increasing rapidly. The introduction of Zorg Domain has been supported by incentives because the GPs demanded payment for the extra work they performed when referring patients. More tests are now ordered locally and fewer tests are performed at the hospital.

Similar challenges were still found in both the UK and the Netherlands. The electronic referral systems have forced changes in the process of care at the interface between primary and secondary care and in standardization between practices. Although these changes had the potential to generate improvements and benefits, such as patient choices, and reduce the number of patients who do not show of for appointments and duplicate tests, they have also generated problems during their implementation, including GP resistance. Dixon et al.(Dixon A 2010) concluded that "Policy ambitions for patient choices may not be realized if the implementation of the booking system is not carefully designed and evaluated".

2.10 Summary of findings from the overview

The purpose of the chapter is to describe the context in which electronic collaboration in health care is developed. The first EHR systems in Norway were developed as early as 1984 and EHR systems are now in used by health workers in both primary care and specialized care. Deployment of EHR systems and standardized messages that can support collaboration has been slower than expected. The large installed base of EHR-systems from different vendors poses an integration challenge.

Norway has mainly a public health system and governmental control is used in order to steer development of ICT-systems in health care The development of ICT in health care has been linked to national strategy plans. New reforms and reorganisation in the health sector have also influenced on the balance between stakeholders who have a role in the development and deployment of ICT systems in health care.

Standardization has been used as a basis for communication across organizational borders, and this communication has so far mainly been based on electronic messaging, but web-based systems are also in use. In other European countries larger collaboration projects are established with varying degree of success.

Referrals have been used as a case in the thesis. Expectations for cost savings from the introduction of electronic referrals have been high. New systems are gradually deployed in Norway and other countries, but a review of larger referral projects also showed that there were significant organizational challenges to be solved.

3. Conceptualizing collaboration in health care

Collaboration across organizational borders requires a common understanding of the following:

- The knowledge that is the basis for the information that is exchanged

- The need for information that supports the involved actors' work processes
- The need for the development of ICT systems that support collaboration

I have focused on three aspects of how knowledge-sharing was involved in collaboration, as follows (see figure 7):

- Communities of Practice (CoP), which emphasize knowledge sharing within relatively small and homogenous groups /communities
- Boundary objects / spanning, which comprises of a set of theories that emphasize how knowledge sharing takes place across groups / communities that are separated by geographical, institutional or professional boundaries
- The Locales framework, which is a proposed framework derived from computer supported cooperative work (CSCW)

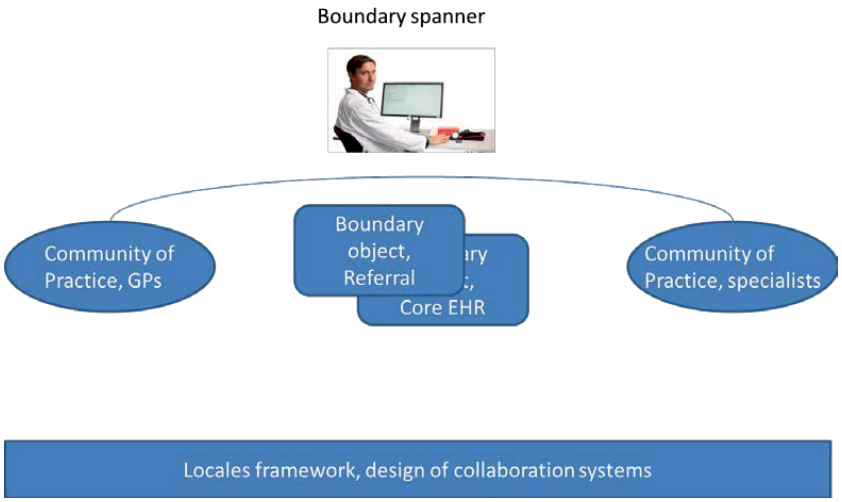

Figure 7: Knowledge-sharing in collaboration[3]

Knowledge can be defined as "the capacity to act" (Sveiby 1997). In the context of a Collaborative, it is knowing what to do with the best practice you hear about and how to apply it in your local situation, i.e., know-how, not just know-what (Kogut and Zander 1992). Making knowledge available to others is an important activity both within organizations and across organizational borders.

The knowledge-based perspective of organizations is rooted in the strategic management literature. As an example, Nonaka et al. (Nonaka and Takeuchi 1995) described how highly successful companies such as Honda, Canon and NEC manage the creation of new knowledge. In 1985, product developers at an Osaka-based company worked on the design of a new home bread-

[3] Figure by Vigdis Heimly, photo by Kai Dragland

baking machine. The first version of the product did not knead dough in a proper way. The crust of the bread ended up overcooked while the inside was hardly performed at all. The employees were unable to solve the problem. They even compared X-rays of dough kneaded by the machine and by professional bakers, but they were unable to obtain meaningful data.
Finally, one of the software developers contacted the Osaka International Hotel, which had a reputation for baking the best bread in Osaka. The software developer followed the hotel's head baker at work and studied the kneading technique. He found that the baker had a very distinctive way of stretching the dough. Based on the experiences in observing the baker, the specifications for the bread-baking machine were changed to include an addition of special ribs inside to reproduce the baker's stretching technique. The unique "twist dough" machine set a record of sales for kitchen appliances during its first year of sales.
The innovation illustrated that both explicit knowledge regarding how to create a machine and the baker's tacit knowledge were needed to create a viable product. Tacit knowledge is personal and can be difficult to communicate to others. Tacit knowledge includes mental models and beliefs in addition to know-how, and it can be a complex process to transfer tacit knowledge to explicit knowledge. In the bread-baking machine example, the employee was successful in this process and used new knowledge as a basis for the creation of a successful innovation.

3.1 Communities of practice

Wenger and Lave (Lave and Wenger 1991) defined Communities of Practice as: "Groups of people who share a concern or passion for something they do and learn how to do better as they interact regularly". Social scientists have used versions of this concept for different analytical purposes, but the origin comes from learning theory. Jan Lave and Etienne Wegner coined the term while studying apprenticeship as a learning model.

Communities of Practice are formed by people who participate in a process of collective learning in a shared domain. Examples of names that can be used for similar groups are the following: social worlds (Strauss 1978), learning networks, and thematic groups or tech teams (Wenger, McDermott et al. 2002). Although the term is relatively new, Communities of Practice have been present throughout history. The resent change is a more reflective behavior of the existence of these communities and of how they can be used in different settings. When these groups are brought into focus, they can make us see past more obvious formal structures and add a perspective that is defined by engagement in practice and the informal learning that comes with it.

Bowker and Star (Bowker and Star 2000) described how a community of practice (or social world) can be a unit of analysis that cuts across formal organizations, for example, institutions such as family and church, as well as other forms of association such as social movements. Becker described this scenario as a set of relations among people doing things together (Becker 1986).The belongings, routines, and exceptions associated with activities constitute the community structure. Newcomers to the community learn by becoming "sort of" members through what Lave and Wenger (1991) called the process of "legitimate peripheral participation." They investigated how this membership process unfolds and how it is constitutive of learning. We are all, in this sense, members of various social worlds, i.e., Communities of Practice, that conduct activities together. Membership in such groups is a complex process that varies in its duration and difficulty and that is modulated by how optional such membership is and how permanent it could be. One is not born a violinist; instead, one gradually becomes a member of the violin playing

community of practice through a long period of lessons, shared conversations, technical exercises, and participation in a range of other related activities.

People live, with respect to a community of practice, along a trajectory (or continuum) of membership that has elements of both ambiguity and duration. They may move from legitimate peripheral participation to full membership in the Community of Practice, and it is extremely useful in many ways to conceive of learning in this way.

According to Wenger (Wenger 1998), three characteristics are crucial for a Community of Practice:

1. **The domain:** The actors who take part in the community have a shared domain of interest. Membership implies commitment to the domain, and it is possible to distinguish members from other people. They value their collective expertise and learn from each other, even though few people outside the group may value or even recognize their expertise.
2. **The community:** In pursuing their interest in their domain, members engage in joint activities and discussions, and they help each other and share information. They build relationships that enable them to learn from each other.
3. **The practice:** Members of Communities of Practice are practitioners. They develop a shared repertoire of resources, such as experiences, stories, tools and methods of addressing recurring problems. The development of the shared practice can be more or less informal. As an example, Wenger mentioned nurses who meet regularly for lunch discussions in a cafeteria where they share knowledge about how they care for their patients.

Communities of practice can develop though a number of activities. Wenger's examples (Wenger 1998) are the following:

- Problem solving
- Requests for information
- Seeking expertise
- Reusing assets
- Coordination and synergy
- Discussing development
- Documentation of projects
- Visits
- Mapping knowledge and identifying gaps

According to Wenger(Wenger 1998), the concept of Communities of Practice has been influencing theory and practice in many domains. From the beginning, this concept was acquired by businesses interested in knowledge management, and it has progressively moved into many other sectors. It has become the foundation of the perspective of knowing and learning that informs efforts to create learning systems in various sectors and at various levels of scale from

local communities to single organizations, partnerships, cities, regions and international organizations.

Wenger (Wenger, McDermott et al. 2002) described how Japanese competition threatened to put Chrysler Corporation out of business in 1988. At that time, Chrysler had a product development lifecycle that was 2 years longer than its competitors. The traditional development process started in the design department. The design department would then send the design to engineering, which could send it back for reengineering several times. The design would then go to manufacturing and possibly back for reengineering until the product was "manufacturable". The focus on functional units could give rise to several unavoidable iterations.

To reduce the development time, the workers were assigned to "car platforms". These platforms were product-oriented and focused on particular vehicle types. The product development lifecycle was shortened by two and a half years, but new problems appeared, namely multiple versions of the same part appeared with small variations, there were uncoordinated contacts with suppliers, there were innovations that could not travel between platforms and there were repeated mistakes.

Based on the clear need for communication across platforms, colleagues from functional areas started to meet informally. Managers recognized the value of these groups and, rather than formalize these emerging knowledge-based groups, they decided to keep them informal but to sanction and support them. The groups were named Tech Teams.

The Tech Teams started to take responsibility for their areas of expertise. As an example, they started to conduct design reviews for their members before the design was approved. The Tech Teams also took responsibility for creating an Engineering Book of Knowledge (EBoK), which was a database that included standards, best practices, lessons learned and supplier specifications. Documenting engineering knowledge had been attempted several times before, but it was now performed as part of the activities and identities of specific communities in charge of designated areas of engineering. This communal responsibility was a key to success. Over time, the Tech Teams progressively established their value as they became an integral part of engineering life at Chrysler. Through the Tech Teams, Chrysler realized the value of what is called "Communities of Practice".

Endsley et al. (Endsley, Kirkegaard et al. 2005) provided examples of what they see as Communities of Practice related to family medicine:

Medical societies such as the American Academy of Family Physicians (AAFP) may be able to direct you to communities of practice in your area of interest and may also have an e-mail discussion list that you can use to post your interest and identify family medicine communities. They may offer courses or other programs that can bring physicians together into communities of practice. For example, there are e-mail discussion lists for those interested in practice management, EMRs (Electronic Medical Records) and clinical topics. Academy members can subscribe to "E-mail Discussion Lists." The AAFP has also sponsored a quality improvement project that was developed and is facilitated by the National Initiative for Children's Health Care Quality (NICHQ). Participants in this program attend learning sessions and also share information and questions via conference calls and an e-mail discussion group.

Quality Improvement Organizations (QIOs) are federally funded state organizations, which were formerly known as peer-review organizations and which provide outreach and support to physicians and medical groups. They organize topic-specific improvement collaboratives and provide well-validated practice tools, such as disease-registry software programs, patient-education tools and disease-management guidelines. QIOs can also provide assistance for assessing and improving your office practice and for becoming involved with other physicians and health care organizations in system-improvement efforts, such as pay-for-performance, information technology and chronic disease initiatives.

Collaboratives are self-selected individuals or groups of practices that have a common aim and that meet to specifically improve a target area of practice (e.g., chronic disease management, access to care, and office efficiency). Participants test well-validated community-shared ideas, tools and interventions for process improvement in their practices. Collaboratives are organized and supported by a number of organizations, such as the QIOs mentioned above, the AAFP, the Institute for Health care Improvement (http://www.ihi.org/), the Bureau of Primary Health Care for federally qualified community health centers (http://bphc.hrsa.gov/), the Indian Health Service (http://www.ihs.gov/), the Group Practice Improvement Network (http://www.gpin.org/) and the American Medical Group Association (http://www.amga.org/).

3.2 Boundary spanning

Boundary spanning primarily concerns the exchange of information. Wenger also drew attention to boundaries because he saw them as "the frontiers where competence and experience tend to diverge: a boundary interaction is usually an experience of being exposed to a foreign competence."

The Knowledge Management (KM) literature has a focus on how individuals can perform boundary spanning roles. Boundary spanners are organizational members who link their organization with the external environment. Cross and Parker (Cross and Parker 2004) characterized boundary spanners as "vital individuals who facilitate the sharing of expertise by linking two or more groups of people separated by hierarchy, location or function". Examples of other papers that address boundary spanning are provided by Aldrich, Herker, Tushman, Scanlan, Caldwell, Pawlowski and Robey (Aldrich and Herker 1977; Tushman 1977; Tushman and Scanlan 1981; Tushman and Scanlan 1981; Caldwell and O'Reilly 1982; Pawlowski and Robey 2004).

Levina and Vaast (Levina and Vaast 2005) studied how organizational competence in boundary spanning emerges in practice. In the two cases that they studied, only a few of the nominated boundary spanners became boundary spanners-in-practice. They showed how boundary spanners-in-practice use various organizational and professional resources, including the influence that comes from being nominated to become a boundary spanner. The three conditions that they found necessary for becoming a boundary spanner-in-practice were the following:

1. The boundary spanner must become a legitimate, but possibly peripheral, participant in the practices of both organizations. The boundary spanner must negotiate between the involved practices, which requires an understanding of these practices.

2. The boundary spanner must have legitimacy not only as a participant, but also as a negotiator on behalf of the fields whose interest he or she represents. This requirement means that he or she must have the symbolic capital that makes others see the agent as being capable of reshaping the practices of the fields of which the boundary spanner serves as a representative.
3. The boundary spanner must develop an inclination for the work. This may arise not only from expecting rewards in the local field but also from an interest in developing new skills.

3.3 Boundary objects

According to Star and Griesemer (Star and Griesemer 1989), boundary objects are "objects which are both plastic enough to adopt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual site use. These objects are abstract or concrete. They have different meanings in different social worlds but their structure is common enough to more than one world to make them recognizable, a means of translation. The creation and management of boundary objects is a key process in developing and maintaining coherence across intersecting social worlds. "

Pawlowski et al. developed the boundary object brokering model of shared information systems (Pawlowski, Robey et al. 2000). They provided an example of how an IT professional can be used as a broker to span organizational boundaries when new shared ICT systems are developed and deployed.

The discharge letters and referrals are used by a set of collaborating actors and are, to some extent, standardized; however, in actual use, they must be fitted to the context in question and can be seen as examples of boundary objects.

3.4 Boundary framework

Carlile (Carlile 2002; Carlile 2004) used Shannon and Weaver's (Shannon and Weaver 1959) three levels of communication complexity, namely, syntactic, semantic and pragmatic, to describe a framework for managing knowledge across boundaries. In comparison to Shannon and Weaver, who had a mathematical focus for the syntactic level, Carlile described progressively complex processes (e.g., transfer, translation, and transformation) at the three corresponding levels.

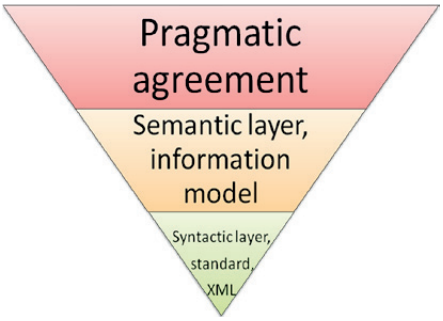

Figure 8: Boundary Framework for Referrals (Heimly 2010a)

This figure illustrates how Carlie's framework can be used for electronic referrals (Heimly 2010a).

At the transfer layer, a communication standard in XML format is used as a basis for communication. KITH developed standards on the basis of existing national standards or international standards from organizations such as CEN/TC251 or ISO. The basis of the standard is generally developed with regard to the user needs and is preferably defined in collaboration with vendors in pilot projects (KITH 2007a). Paper-based templates and forms can also be used at the bottom layer of the framework. The standard can be regarded as a boundary object that is used in many different ways.

The semantic translation layer will consist of interpretations of the standards for daily use, where clinicians and other health care workers have made agreements on what types of information they will exchange.

The same standard can be used in slightly different ways for different specialties, such as is exemplified with rehabilitation and physio-therapy. The Communities of practice in the collaborating organizations will have requirements and suggestions for the information model in question, and boundary spanners will need to negotiate with actors at both ends to determine the end result. In some cases, there will also be nationally developed information models and recommendations, such as the "good referral" (KITH 2002). These standards must be extended and fitted with local requirements from the hospital and GPs. Requirements will also change over time and could lead to revisions of the boundary object.

At the transformation layer, different interests among actors must be sorted out and could lead to changes in daily work processes. It is important to stabilize the system in such a way that all of the actors can see benefits from using the new services, as exemplified in the report by Cannaby et al. (Cannaby, Westscott et al. 2004) where the introduction of electronic referrals in Denmark is analyzed.

3.5 Locales framework

Collaborative processes can involve actors from many organizations who work with complex problems. It is necessary to understand the nature of the work to be able to design a system that

supports the actors' work processes. Various methodologies, both qualitative and quantitative, can be used to obtain an understanding of the work. These methods can include ethnographic approaches for data collection, the use of grounded theory for analysis, qualitative or quantitative evaluation and meta-analysis for extracting common themes and generalizations. Different theoretical approaches for understanding the nature of cooperative work include ethnomethodology, symbolic interactionism, activity theory and distributed cognition. As an example, Bowker and Star performed an analysis of information systems in medical communities with a focus on the development of the International Classification of Diseases (ICD) and the design of a Nursing Interventions Classification scheme (NIC) (Bowker and Star 1991; Bowker, Timmermans et al. 1995). They noted that community system designers must build products for multiple social worlds simultaneously and that the design of classifications and standards requires a deep understanding of the structure and nature of the community where they are going to be used.

Fitzpatrick (Fitzpatrick 2003) described how wicked problem situations can involve people who interact in and with complex contexts involving social, organizational, physical and technical dimensions. She based her work on input from many different sources in the CSCW community. The initial system and study was of wOrlds, an environment for collaborative work, and of CSG, a computer-supported organization. She conducted a study on CSG to explore the potential for the use of wOrlds. She discovered that wOrlds had to be partly redesigned to support the complex social organization of CSG. This work provided the foundation for the Locales Framework.

Fitzpatrick (Fitzpatrick 2003) defined the Locales Framework based on five aspects:

1. Locale foundations that identify the social world with spaces and resources
2. Civic structure that identifies relationships of the social world and the locales
3. Individual views as different perspectives of the locale
4. Interaction trajectories that identify the dynamic and temporal aspects of the living social world and the interaction within and across locales
5. Mutuality, identifying the mutual communicative process through which awareness is achieved

She says these five aspects are thought to capture the complexity of reality and can potentially help to position concepts into a coherent framework. They can support the following:

- Analysis of work in complex situations
- Design of systems motivated by an interactional rather than a technological perspective

These aspects all provide different perspectives or ways of understanding the locale in question; however, they are can be interdependent and are partly overlapping. The locale is constituted in the relationship between the social world and its use of space and resources.

An example of the use of the Locales framework is provided by Romero et al. (Romero, McEwan et al. 2007). These authors reflected upon differences between anticipated and actual user behaviour when using a system (community bar) that was designed based on the framework theory.

One of the larger mismatches that Romero and McEwan saw was in how people formed and used locales *vs.* how they were expected to be used. Rather than use places, people instead used small groups to dynamically form, attend, and dissolve mini-locales within a place. The central issue appeared to be that, despite efforts to remove the rooms metaphor, places are still too much like rooms. This concern raised questions about other groupware in this genre that attempts to "organize" locales by either spatial metaphors or by having application-centric gatherings. They concluded that the locale formation had to be an easy, perhaps implicit process that emerges from a community as they interact, rather than from the creation of an explicit structure a priori. Nevertheless, designing for such an implicit and tacit process is difficult.

4. Methods

Some relevant methods for my work are presented in this chapter.

Traditionally, there have been two types of research for the social sciences: qualitative and quantitative research. Today, it is also scientifically accepted to use mixed methods in which elements of qualitative data collection as well as quantitative data collection are used in the same research project. Quantitative research is based on hypothesis testing, the use of statistics and a large sample size. Qualitative research is usually based on small-scale data, which are presented in either verbal or non-numeric form. Inductive logic is used, and theoretical ideas and concepts often originate from the data.

4.1 Reviews

An initial review involves a systematic identification and analysis of documents that contain relevant information for the research problem. The main aim of the literature review is to find documents that can help to design the research project, including the definition of research questions.

Electronic databases are used as an aid with which to find relevant references. Different databases can be best suited for different searches according to which topic the search is directed towards. Medline and PubMed would, for example, be suitable for searches within medicine, but these databases are also useful for searches that are related to health informatics. On the other hand, information regarding health informatics could also be located in more general databases, such as Scopus, JSTOR or Web of Science, or in databases that are more directed toward computer science, such as CiteSeer. Google Scholar also provides a comprehensive basis for searches. Comparisons of some of these databases have been performed by several researchers (Jacso 2005; Bakkalbasi, Bauer et al. 2006; Falagas, Pitsouni et al. 2008).

From initial references, researchers can also use a "snowballing" method, whereby they follow a thread of citations that they find interesting from paper to paper. By reading different papers, it can also be interesting to see how citations are used in the different contexts.

4.2 Case studies

According to Yin (Yin 2009), a case study is an empirical inquiry in which the focus is on a contemporary phenomenon within its real-life context, and the boundaries between a phenomenon and its context are not clearly evident. Case studies are often used to answer questions such as "how" and why"; the investigator has little or no control over the events, and a contemporary phenomenon in a real-life context is involved.

Yin (Yin 1994) identified three types of case studies: explanatory, exploratory or descriptive.

Some of the criticisms that have been raised against case studies are that they may lack a systematic handling of the data and that it can be difficult to generalize from the results. Case

studies can also be very time consuming. Flyvbjerg (Flyvbjerg 2006) summarized what he calls five misunderstandings or oversimplifications regarding the nature of case studies:

1. General, theoretical (context-independent) knowledge is more valuable than concrete (context-dependent), practical knowledge.
2. One cannot generalize on the basis of an individual case and, therefore, the case study cannot contribute to scientific development.
3. The case study is most useful for generating hypotheses, whereas other methods are more suitable for hypotheses testing and theory building.
4. The case study contains a bias toward verification, i.e., a tendency to confirm the researcher's preconceived notions.
5. It is often difficult to summarize and develop general propositions and theories on the basis of specific case studies.

Flyvbjerg (Flyvbjerg 2006) concluded that the case study is a method that works well when compared to other methods. On the other hand, he also supported the notion that the separation that is often made between qualitative and quantitative methods is not beneficial. He stated that, very often, a combination of qualitative and quantitative methods will accomplish the task best.

Information in case studies can be gathered in different ways. Yin (Yin 2009) suggested six different sources that can be used, as follows:

1. Documents (letters, agendas, progress reports)
2. Archival records (service records, organizational charts, budgets)
3. Interviews (typically open-ended, but focused, structured interviews and surveys are also possible)
4. Direct observations (formal or casual; it is useful to have multiple observers)
5. Participant observation (assuming a role in the situation and obtaining an inside view of the events)
6. Physical artifacts

The different sources can be used to perform a triangulation that increases the construct validity.

Klein and Myers (Klein and Myers 1999) stated that conventions for evaluating information system case studies conducted according to the natural science model were widely accepted, but that this acceptance was not the case for interpretive field studies. They proposed a set of principles for the conduct and evaluation of interpretative field studies. They classified Information Systems research as interpretative if it is assumed that "knowledge of reality is gained only through social constructions such as language, consciousness, shared meanings, documents, tools and other artifacts. Interpretive research does not predefine dependent and independent variables but instead focuses on the complexity associated with the development of human knowledge, or sense, as a situation emerges". Myers (Myers 1997) also stated that qualitative research may or may not be interpretative depending on the underlaying assumptions of the researcher. Other researchers, such as Kaplan and Maxwell, do not provide a clear distinction between interpretative research and qualitative research (Kaplan and Maxwell 2005). In their

study (Klein and Myers 1999), Klein and Myers limited their scope to addressing one type of interpretative research, namely the interpretative field study. Field studies can include in-depth case studies, as exemplified by Walsham (Walsham 1993), and ethnographies, as exemplified by Suchman (Suchman 1987) and Hammersley and Atkinson (Hammersley and Atkinson 2007). According to Yin (Yin 1994; Yin 2009), ethnographies require long periods of time in the field and emphasize detailed observational evidence. In contrast, case studies are a form of enquiry that does not solely depend on ethnographic or participant-observer data.

The principles developed by Klein and Myers (Klein and Myers 1999) include the following:

1. The Fundamental Principle of the Hermeneutic Circle
2. The Principle of Contextualization
3. The Principle of Interaction Between the Researcher and the Subject
4. The Principle of Abstraction and Generalization
5. The Principle of Dialogical Reasoning
6. The Principle of Multiple Interpretations
7. The Principle of Suspicion

An analysis of the material from case studies can be accomplished in different ways. Illustrations, schemas and tables can be used. It is also possible to perform the coding of transcribed documents and to analyze text by means of tools such as nVivo or Atlas.ti.

4.3 Interviews

Interviews are commonly used as a method for gathering information from the informants in qualitative research. The information could be used free standing or used in combination with information that has been gathered through observations, surveys or studies of written documents. The interview material is typically analyzed and used as a basis for generalization. Clarke (Clarke 2003) provided examples of how generalization from interviews can be accomplished by means of Grounded Theory. Grounded theory was developed by two sociologists, Barney Glaser and Anselm Strauss (Glaser and Holton 1967; Glaser, Strauss et al. 1968; Strauss and Corbin 1997). Rather than beginning with a hypothesis, the first step according to this theory is the collection of data. From the data that are collected, the key points are marked with a series of codes, which are extracted from the text. The data are used as a basis for the creation of a theory or for the development of a reverse-engineered hypothesis.

According to Holstein and Gubrium (Holstein and Gubrium 1995; Gubrium and Holstein 2002), an analysis of the qualitative data should ideally not only make the data "tell their own tale" but also make the data be seen in the context in which it was gathered. The way in which the interviewed individuals behave during the interview might, for example, also provide insight into how the interview should be interpreted. The process by which the data were gathered could sometimes, in itself, be as important as the data.

Interviews can have different forms, from very structured to unstructured. Structured interviews are based on a very detailed interview guide, and the same questions are asked of all of the informants. The results from this type of interview are often used in quantitative research. Examples of this type of interview are polls that are conducted by phone. Very often, the people

who are interviewed can choose between different predetermined options, and many of the questions can be answered as either “yes” or “no”.

When conducting a semi-structured interview, the interview guide will often include a list of issues that he or she wants to talk about during the interview. Questions will very be more open-ended than in structured interviews, and there are a few yes/no questions. The intention is that the interviewed person should formulate the answer in his/her own words. The interviewer is steering the interview, but the interview should ideally be more like a conversation between two equal partners. If new issues are raised during the interview, the interviewer would often follow a new thread with new questions.

Unstructured interviews can be used when the researcher is new to the theme or when the informant’s own understanding of the topic is regarded to be of great interest. The theme and questions can be very general, and the interview is more like an informal conversation between the interviewer and the informant. The knowledge gained from an unstructured interview may later become the basis for a later semi-structured interview.

Some criteria that, according to Kvale (Kvale 2008), influence the quality of an interview are the following characteristics of the interviewer:

Knowledgeable
Has an extensive knowledge of the interview theme and can conduct an informed conversation about the topic.

Structuring
Introduces the purpose of the interview and summarizes what was learned.

Clear
Poses clear, simple, easy and short questions. Speaks distinctly and understandably and does not use academic language or professional jargon.

Gentle
Allows the individual being interviewed to finish what he/she is saying and allows him/her to proceed at his/her own rate of thinking and speaking.

Sensitive
Listens actively and seeks to have the nuances of meaning described more fully. Is empathetic and not only hears what is said but also hears how it is said.

Open
Is open to new topics that can be introduced during the interview and follows up on them.

Steering
Controls the course of the interview and is not afraid of interrupting digressions from the interviewee.

Critical
Does not take everything that is said at face value, but instead questions critically to test the reliability and validity of the interviewee's story.

Remembering
Recalls earlier statements from the interview and asks to have them elaborated, or relates the points made during the interview to one another.

Interpreting
Manages, throughout the interview, to clarify and extend the meanings of the interviewee's statements.

4.4 Focus groups

Interviews can also take place in a group context (Morgan 1997). Group interviews can be structured, semi-structured or unstructured. Bogardus's (Bogardus 1926) description of group interviews is among the earliest published studies on this topic. A focus group interview is a group interview on a specific topic. It is an open-ended group discussion that the researcher guides and typically extends over at least one hour.

Focus groups can be used in the initial phase of a study to prepare for the main collection phase. They are also used together with other methods, such as observations, individual interviews, and questionnaires.

Data from a focus group can be recorded by audio recording or by written notes and can be analyzed by the same principles and processes as the analysis of other qualitative data.

4.5 Surveys

The distinguishing features of surveys are the form of the data that are recorded and the method of analysis. Surveys are characterized by a structured or systematic set of data that de Vaus (De Vaus 2002) named the data grid. Information regarding the same variables or characteristics from at least two cases is included in the grid. A survey analysis will describe the characteristics of a set of cases. In addition, a survey analyst attempts to locate the causes of the phenomena by comparing the cases.

According to de Vaus (De Vaus 2002), survey research has been widely regarded as being inherently quantitative and positivistic in contrast to qualitative methods that involve participant observations, unstructured interviewing, case studies and focus groups. He saw this distinction as misleading. At the collection stage, he found it more helpful to talk about techniques that yield structured or unstructured data.

The survey process often includes the following steps:

Clarification of research questions
Decisions about scale, reference frame and experimental design

Development of indicators for concepts
Clarification of the concepts, development of the indicators, and evaluation of the indicators

Finding a sample
According to Robson (Robson 2005), the types of sampling plans can be divided into probability sampling (in which the probability of the selection of each respondent is known) and non-probability sampling (in which the probability of the selection of each respondent is unknown). Probability sampling includes simple random sampling, systematic sampling (sampling of every xth person), stratified sampling (reflects the proportion of various groups in the population) and multistage cluster sampling. Probability samples are often large-scale samples.

Small-scale surveys often employ non-probability samples. They are usually less complicated to set up and are acceptable when there is no intention or need to make a statistical generalization of any population beyond the sample group surveyed.

Construction of the questionnaire

Decisions about closed- or open-ended questions must be made. Questions should not be leading or easy to misunderstand. The questionnaire should not be too long and should be easy to read. The questionnaire should be validated.

Analysis

Data must be prepared for analysis. Possible casual variables should be excluded when choosing variables for analysis.

Methods for analysis can be univariate, bivariate or multivariate. Univariate analysis is performed based on the description of a single variable and the attributes of the applicable unit of analysis. Bivariate analysis involves the analysis of two variables (often denoted as X and Y) for the purpose of determining the empirical relationship between them. Multivariate analysis involves the observation and analysis of more than one statistical variable at a time.

4.6 Analysis of qualitative data

There is no clear and universally accepted method for the analysis of qualitative data as there is for the analysis of quantitative data, but there are ways in which qualitative data can be handled systematically. When qualitative data are a supplement to quantitative data, there is no need for a fixed design or a complex analysis. A summary of the comments or the use of citations will often be helpful.

If the collection of qualitative data is the only aspect of the study, or if a large amount of qualitative data must be analyzed, more attention should be paid to the analysis. Robson (Robson 2005) described three different approaches to qualitative analysis:

Quasi-statistical approaches

Work or phrase frequencies and inter-correlations are employed as key methods for determining the relative importance of terms and concepts.

Thematic coding approach

Data are coded (identified as representing something of interest) and labeled. Codes with the same label are grouped together as a theme. Codes and themes occurring within the data can be determined inductively by reviewing the data and/or by its relevance to the research questions, previous research or theoretical considerations. The themes can serve as a basis for further data analysis and interpretation.

Grounded theory approach

This is a version of thematic coding in which the codes arise from interaction with the data. Codes are based on the researcher's interpretation of the meanings of the patterns within the text. The results are "grounded" in the findings from the data.

5. Data collection

The primary methods of data collection for the thesis are illustrated in figure 9.

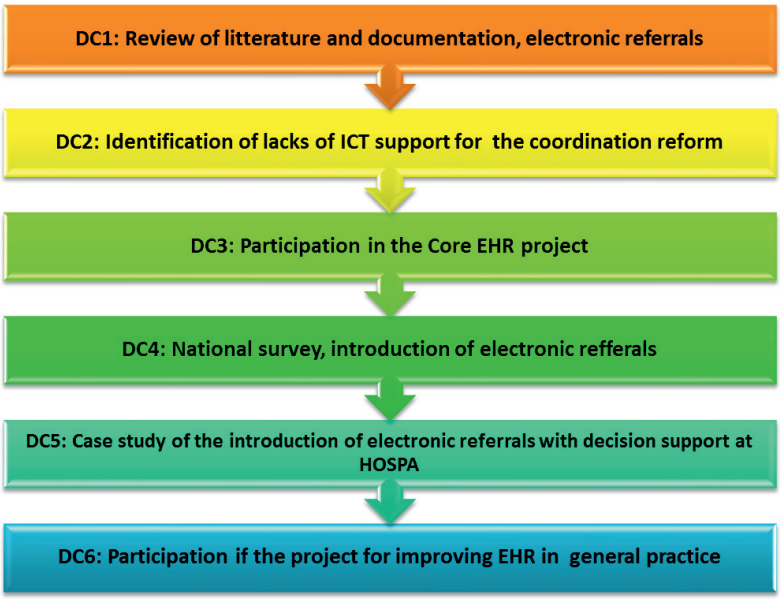

Figure 9: Data collection process

The collection of data was mainly performed in the numbered sequence, but DC5 was stretched over a longer period and done partly in parallel with other activities. The review (DC1) was originally performed at an early stage of the work, but was later supplemented.

5.1 Review of Electronic Referrals in Health Care, DC1

As a basis for my research, I performed a review of electronic collaboration projects in health care, using electronic referrals as a case. My criteria for the selection of the projects were as follows:

1. Projects that were deployed, or were intended to be deployed, on a large scale.
2. Projects from countries that have a health care organization similar to that of Norway.
3. Projects that appeared to be of national interest and had been ongoing for some time, but some promising newly started projects were also included.

I mainly used Scopus as a basis for my search for relevant scientific papers, and I also backtracked to citations in the papers that I found in my searches (snowballing). I used combinations of terms, such as electronic referral, discharge letter, discharge summary, ehealth and review, as a basis for my search. I did not do a count of the number of hits, but I picked projects from the hits based on the three above mentioned criteria. I also used national strategy documentation, action plans and project documentation as a basis for the review.

The review was done at an early stage of my PhD work, and the main intention was to get an overview of large scale projects and not a more complete picture of referral projects. The review was a supplement to information from some of the work that I had already been involved in (Heimly 2008a), in which I had been in close contact with the vendors and HAs.

5.2 The Coordination Reform study, DC2

The Norwegian Government has identified electronic collaboration as an important tool with which to support an upcoming reform in Norwegian Health Care, namely the Coordination Reform. The goal of the reform is to prevent citizens from becoming patients and to reduce the need for specialized care. The patients are also supposed to become more active in taking responsibility for their own health. A study was performed to obtain an overview of the status of electronic collaboration in the Norwegian health care sector today and of the challenges from a lack of such collaboration that can be seen in light of the coming reform.
This work is based on the input from a reference group, meetings with potential users and national strategy documents. A situation analysis of eight trajectories that span primary and secondary care was performed.

The work was initiated by the Norwegian Centre for Informatics in Health and Social Care (KITH) and was supported by Innovation Norway. The project team included three members from KITH and the Norwegian University of Science and Technology (NTNU). The work was mainly based on available project reports and national strategy documents. The group had additional meetings with the Norwegian EHR research center and a project manager at one of the larger Norwegian Hospitals.

The project team was supported by an external reference group with members from the following:

- Innovation Norway
- The Norwegian Research Council
- Trondheim Municipality
- The Norwegian EHR Research Centre
- The Directorate of Health
- The Ministry of Health
- The Norwegian Centre for Telemedicine and Collaboration

The reference group had two physical meetings, and the members also participated actively in commenting on input from the project team. Based on the input from a reference group, meetings with users and available documentation, a situation analysis of six trajectories was performed. The

main results are summarized in a collaboration map that provides guidelines on which areas require more focus in the future development of collaborative systems. The collaboration map was sent back to the members of the reference group for validation.

The study was completed in August 2009. A supplementary study on patient communication was completed in September 2010.

Jacob Hygen from KITH was project manager for the project. I did the main analysis of the data, including the making of the collaboration map in table 1.

5.3 The Core EHR project case study, DC3

To provide easy access to updated medication information, a project for consent-based access to a core EHR information, The Core EHR project (P6) was established in Trondheim municipality. The GPs in the municipality had been using EHR systems for more than a decade and no longer used paper. The EHR systems included a drug chart module, but only medication that was prescribed locally was automatically updated. Information regarding medications that had been prescribed at the hospital, by specialists or by other GPs had to be updated manually.

The GPs required that the integration of the Core EHR with the drug information should be seamless and invisible to the GP to fit with their work processes. The GPs wanted the drug chart to look the same as before, but they wanted it to include addition information regarding medication changes made by other actors.

The project in the Trondheim municipality only accounted for 1/3 of the EHR vendors in Norway, but with a joint project between Stavanger, Tromsø and Trondheim, all of the major vendors would be accounted for. Therefore, the three projects decided to use the same core EHR basis and the same message standards. This scenario was challenging because it implied that many vendors must be involved; vendors of EHR systems for hospitals, municipal care centers and primary care centers all needed to update their systems. Even if the changes were not large, it was a time-consuming process because the vendors had different release dates and priorities.

To comply with Norwegian legislation, the core EHR was updated by messaging. The model was based on written consent from the patient to allow the sharing of medical information. The patient's GP was responsible for the content of the patient's core EHR and checked that all of the information that was added to the core EHR was updated and correct.

The strategy described above for establishing both the technology and a suitable collaboration for securing the updated information for the municipality's clients can be seen as an example of action research. "Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint *collaboration within a mutually acceptable ethical framework"* (Myers 1997). I participated actively in the core group where the project initiated from, was a member of the steering committee for a period of one year, and I was also project manager for the project for one year.

The cooperation with NSEP and the University of Technology and Science in Trondheim (NTNU) has also provided an opportunity for two students (Kirsti Berntsen and Gro Alice Hamre) to do an ethnographically inspired study to gain insights into the future users' daily work practices, routines and challenges. This work included semi-unstructured and unstructured interviews with nine organizational units collaborating on the medications of the client.

While the government's and other actors' motivations were mainly to develop specifications and a basis for a core EHR that could be deployed nationally, the resulting project and its broader scope fit the theoretical definition of action research. Additionally, the wide participation of vendors and users aimed at bridging and negotiating the differences and requirements of a wide range of diverse actors.

The project employed a development method that has been applied by several cooperative projects within the health sector in Norway : End users develop requirements for additions to the EHR systems that can facilitate the collection of the information that is necessary for work practices. This requirement specification process is performed in cooperation with providers, vendors, researchers and standardization workers. New standards, or extensions to existing standards, are developed by KITH based on user inputs. Vendors subsequently develop new EHR modules based on requirement specifications. The modules are then tested in the usability lab at NSEP, and the vendors' implementation of the communication standards is tested by the national testing and approval service at KITH. The vendors are refunded only 30-50% of their development costs via public funding. The remaining development costs are meant to be covered by customer licenses when the project is spread to new users. As part of the project, a core EHR module has also been developed.

I was technical project manager for the project, and was also involved in work with establishment of the project together with managers from the municipality.

5.4 The National Survey of the Deployment of Electronic Referrals, DC4

To obtain more information about the status of the deployment of electronic referrals in hospitals, I decided to conduct a national survey in collaboration with the Directorate of Health and their project Meldingsløftet.

I also participated in three national project meetings in Meldingsløftet and presented my results from the survey with the participants. These meetings were documented in field notes.

The main rationale behind the survey was to discover the following: the status and plans for electronic collaboration with external actors seen from the hospital level, what the hospitals see as their main challenges for deployment, whether the introduction of new software is linked to organizational development within its own organization or across organizational borders, and how such a linkage occurs.

The questionnaire

The questionnaire was sent to all of the 28 Norwegian Health Authorities (HAs) in September 2008. Each HA covers one or more hospitals.

Development of the questionnaire

I developed the questionnaire in collaboration with the Directorate of Health. I also sent it to one of the hospitals to be validated and improved.

The questionnaire was intentionally made short and included 10 questions. The number of questions was quite limited due to the tradeoff between a long questionnaire and the possibility of allowing more time to be spent on answering the questions. The questions were a mixture of quantitative and open-ended qualitative questions. The following are some examples:

- *How large is the proportion of electronic referrals compared to the total number of referrals you receive? Options for the answer were 0, 1-25%, 25-50%, 50-75%, or 75-100%.*
- *Do you engage practice consultants in electronic collaboration projects?*
    - *If yes, then describe their role briefly, 3-5 lines.*
- *Briefly describe the changes in the reception of electronic referrals.*

Analysis

The qualitative answers from the HAs were summarized in an Excel table, and a simple statistical analysis was performed. The qualitative answers were analyzed separately. The analysis was done by me.

Additional data for the survey

I had previously worked together with representatives from one of the hospitals in the Meldingsløftet project. Through my participation in the project, I also performed some interviews at the hospital and with a GP in primary care who collaborated with the hospital.

The interviewed hospital personnel were the following: the project manager for the referral project at the hospital, the project manager who had the overall responsibility for the hospital EHR systems, a waiting list coordinator at two different wards, and a work-flow analyst and projects manager for the patient logistics project at the hospital. The interviews were semi-structured, and notes were taken from the interviews.

5.5 The case study at HOSPA, DC5

This case study is a single-case holistic study conducted at a medium-sized Norwegian hospital, HOSPA. The study was connected to a project that aimed at improving the referral quality based on decision support. The GP practices already introduced electronic referrals two years before the project started, and some GPs were sending electronic referrals to the hospital, but on a limited scale.

Clinical guidelines were maintained in a tool called the EHR interactor. The EHR interactor system was linked to the specialist's EHR system. Once a new guideline was updated at the hospital, it would also immediately be made available in the GP's EHR system. The guidelines were linked to ICPC2 (International Classification of Primary Care) codes. This coding system is used by all Norwegian GPs. Some guidelines could apply for a whole group of codes, and the guidelines would then be shown to the GPs for all of the relevant codes.

The electronic referral was integrated with the GP's EHR system. When the GP decided to refer a patient to specialized care, information from the patient's EHR would automatically be transferred to the referral form. This transfer included information about the patient's current medications, family history and present status. Once the relevant diagnosis code was filled in, a window with relevant guidelines would appear on the right side of the screen if such guidelines were available. There was no strict control regarding whether the GP followed the guidelines or not; the guidelines were merely a support for the daily work activities. The referral was then sent as an electronic message to the hospital. There was technically no difference in how the referral message was sent and in whether the decision support was used or not.

Clinical guidelines were developed by the specialists at the hospital. The guidelines were based on international guidelines and recommendations, but they were also, to some extent, adjusted to address local needs. Five sets of guidelines were developed for urology.

Six GP practices and two hospital wards (gastroenterology and urology) were chosen for the project. An average of 6-7 GPs worked in each general practice.

I was not involved in the design, development or implementation of the system, but I followed the project in the deployment phase in order to see what experiences could be gained from the project that could be beneficial both for the project owners at the hospital and at a national level.

Participation in meetings at HOSPA

I participated in meetings of the steering committee, a project group meeting and three meetings with project members at HOSPA. I took field notes from the meetings.

Group meetings with the GPs at their local practices

I participated in group meetings where all of the GPs, nurses and secretaries who were present in the office participated together with project group members from HOSPA. The project staff from HOSPA included a project manager, technical staff and preferably also one of the practice consultants or GPs who had been active in the project. The meetings started with a brief presentation from HOSPA, but apart from that, the GPs talked about the experiences they had with the system thus far and asked questions about the issues they were unsure of or about things that they wanted to have improved. The discussions were open-ended, and the meetings had a form that was quite similar to that of a focus group interview. One meeting was held at each of the 6 general practice locations that participated in the project. I took field notes from the meetings.

I did semi-structured interviews with the following people:

- Administrative staff who were responsible for handling the referrals when they first reach the hospital.
- Specialists who were responsible for the development of the clinical guidelines.
- GPs who participated in the project as user representatives or practice consultants.
- GPs who had experience with the use of the decision support system in their daily work.

These interviews were performed independently from the meetings. There are usually 5-7 GPs who are employed at each location, but they are seldom present at the meetings at the same time. All of the GPs who were present at the time of the visit were interviewed, regardless of what their role in the project had been. A total number of 20 GPs were interviewed. In one location, only one GP was interviewed because this location was just recently included in the project and had little experience with the software thus far. The other GPs had used the system for 6-10 months at the time of the interviews. Four GPs were interviewed at four locations, and three GPs were interviewed at the last location. The interviews were semi-structured, and Kvale's criteria for interviews were followed as closely as possible (Kvale 2008). The GPs were free to provide all of the input that they wanted about experiences with the project, but some questions were asked to all of the GPs (see appendix 3). Examples of such questions related to the use of the guidelines are the following:

- What do you think of the level of detail requested in the recommendations in the guidelines?
- When do you use the guidelines, and do you see any benefits from using them?
- Which improvements do you think should be made in the decision support system?

The GPs were very busy, and the interviews were conducted between patient visits or when the GP could "squeeze in" a small amount of time for an interview during the day, which was often during lunchtime.

Other data sources
I have also used field notes that I have taken during my participation in national meetings and seminars related to electronic collaboration in the health sector. I have also used project documentation and national strategy documentation.

Analysis
I have transcribed the interviews. Text from the interviews and the field notes were coded thematically (Robson 2005) and were analyzed in nVivo by me. Examples of themes used for coding were "suggestions for improvement, practice consultants, challenges, the patient's choice of a specialist, good referrals and work processes".

5.6 Reference Group case study, DC6

Because a wide range of ICT systems have been installed by actors who collaborate with the GPs, an increasing need for extensions and changes to their local systems has emerged. The vendors of the GPs' EHR systems are confronted with many requirements from actors such as the

Directorate of Health, the regional health authorities, NICT and the national insurance scheme. During recent years, the EHR vendors have been obliged to satisfy national requirements. The vendors have user forums and user groups, but the users claim that the vendors cannot afford to prioritize the local needs to the same extent as before because they must pay more attention to needs from the collaborating actors and authorities. The GPs do not have a national body through which they can be represented in a national setting. They are linked to the Municipal Authority (KS) and the Norwegian Medical Association, but these organizations have a focus, which the GPs consider to be too wide.

A group of GPs with a lot of ICT experience took the initiative to establish a national reference group in 2010. The reference group members have been the main drivers in the project. The Norwegian Medical Association has a subgroup called the Norwegian Association for General Practice, to which the reference group is connected. Their focus is on the further development of electronic health record systems in general practice. The GPs in the group have broad experience from being pilot users in various ICT projects, practice consultants or user representatives in the vendors' users groups. The GPs also have a very active online forum in which they vividly discuss ICT-related issues. The reference group also uses this forum to obtain active feedback on the work that they do. A subgroup with three GPs, each of whom had experience with EHR systems from different national vendors, was selected for the project group. All of the three GPs had experience as practice consultants, as leaders of vendor user forums or through participating in large national projects. The representatives in the subgroup had close contact with all of the other representatives in the reference group through a very active mailing list. The list is open to anyone who wants to participate, but you must introduce yourself on the net to all of the other members before you join the group.

My role in this work has been to serve as an administrative project manager for the subproject, Kartleggingsprosjektet, to help them structure their suggested action points and requirements in a document that can be used as a basis for national bodies and vendors (KITH 2011). I have also participated in work to attempt to help them obtain national funding for some of their activities, and I have acted as one of their contact people to the Directorate of Health. I have suggested a future model for collaboration between national bodies is suggested based on the experiences from the project.

6. Results

6.1 The Review of Electronic Referrals in Health Care

The review showed that ongoing referral projects differed substantially from country to country. It did not seem to be one best solution that proves to be beneficial for all countries. Legislation, organization of the health care system and cultural differences are factors that could influence the solution choice. Electronic referrals are assumed to have a large potential for economic savings as a whole, but cost benefits also appear to be lower than was initially expected. Denmark appears to be successful with a short roll-out period for the referral hotel, but for other systems examined, the deployment process has taken much longer than was initially expected.

Electronic referrals are requested in many countries, but experiences from the ongoing project like Zorg Domain (Bal, Mastboom et al. 2007), Plan and Book (Eason 2007; Dixon A 2010) and Medcom's referral projects and the Referral hotel (Medcom 2008) indicates that the roll-out processes are long and that there will be a migration toward new solutions.

Referral projects as Zorg Domain and Plan and Book provide possibilities for booking referrals in combination with clinical guidelines and possibilities for streamlining the referrals according to specific needs for different specialties and local hospital/region needs. My experiences from the referral project at HOSPA (Heimly and Nytro 2011) showed that it was important to address the sociotechnical aspects. When the project started, there was not a clear common understanding of each other's work processes and needs among clinicians in primary care and at the hospital. The importance of integration of the referral solution with the EHR system was also not seen as important when the project started, but this was improved during the project period.

Validity

I decided not to look into a comparison of all of the smaller pilots, as projects that covered a limited number of users or only a few medical specialties. I did also not look into projects that were just recently started or were only planned started. It is certainly possible for some of these projects to scale up at a certain point in time, but it would be too much work to attempt to obtain information on and statuses of all of these projects and to attempt to compare them.

Most projects in this review originate from northern European countries. Contributions from southern European countries can be available in languages other than English, but I have not been able to find any.

The extent to which evaluations of larger national collaboration projects are performed may vary between countries. Some evaluation reports are produced by independent researchers, while other reports can be produced by external consultants or project members. This scenario makes it difficult to know how objective the evaluators have been.

6.2 The Coordination Reform study

The collaboration map in table 1 (KITH 2009; Heimly and Hygen 2011) summarizes the status of electronic collaboration in health and social care. The y-axis shows the main actors, and the x-axis shows the trajectories that involve the different actors. For each collaborating actor, a color code and a number indicate to what extent the prerequisites of the ICT-supported collaboration are present. The figure does not show to what extent the available solutions are used in practice.

Trajectory/ Actor	Medical colla-boration	Community care	Shared care	Acute care	Service and support functions	Preventive care	Public insuranse colla-boration	Casual patient contact with GP/dentist
Patient	1	1	1	1		1	1-2	1-2
Community care	3	3	1-2					
GP	2-3	3	1-2	1-2	3	1-2	3	1-2
Accident and emergency unit				1-2				
Health station	1-2					1-2		
Hospital	2	2	1-2	1-2	3	1-2	2	
Private specialist	2-3		1-2	1-2	2	1-2	3	
Pharmacy	1	1			1		2	
Dentist								1
Public insurance partner							3	
Hab/ rehab	1-2	1-2	1					
Lab/ X-ray	3				3			
Ambulance (car/boat/ air)				1				
Employer							1	

Table 1: Collaboration map, (KITH 2009; Heimly and Hygen 2011)

The color codes used are as follows:

	Non-relevant
1	Few systems with collaboration support are implemented. Standards are missing.
2	Few systems with collaboration support are implemented. Some standards are available.
3	Essential standards are available and several systems that can be used for collaboration are implemented.
4	Certified and standardized collaboration solutions are commonly available.

The numbers are used for the support of the color coding and are also used to indicate a level between two of the colors.

The main finding was that systems that should support shared care and that empower the patient are, to a large extent, lacking. This scenario is contradictory to the Coordination reform's intention of empowering the patient, and it should be the focus of further development.

Suggestions for future work were the following:

- Development of a public health portal
- Development and deployment of telecare solutions to support independent living
- Improvement of electronic collaboration between health workers

Development of a public health portal

A public health portal should provide citizens with quality-assured documentation that can be used for self care. Information about patient rights, admitted benefits and the status of application processes should be made available. Patients should be provided with services for electronic collaboration with the GP, including secure e-mail access and appointment booking. The patient should also be provided with services for the choosing and booking of specialized care services.

Development and deployment of telecare solutions to support independent living

Telecare should be used to support patients in their daily routines and possibly to reduce the need for hospitalization.

Improvement of electronic collaboration between health workers

The national ePrescription system should be made available to all of the actors who need access to this system. Standardized communication between the maternal and child health stations and other actors such as the GPs, maternity wards at the hospital, schools and the national registry of immunizations should be implemented. A national pregnancy chart with core information that must be shared by the pregnant woman and a group of health workers should be developed. Priority must be given to improve the standardized electronic exchange of radiology information. The development and deployment of services for tracing lab requisitions and referrals are needed. A core EHR system with patient summary information and an overview of the patient's contacts with different actors is also required.

More effort should be put into innovative processes that support development of new collaborative systems. All of the actors who will be involved in collaborative processes must obtain some type of benefit from using the new system.

Validity

The work is a snapshot of the status at the time at which the work was conducted, and new projects have been initiated since the evaluation was conducted. Still, many of the same challenges remain in December 2011.

The collaboration map was created mainly on the basis of input from the members of the reference group. The reference group could have been broader and could have included members from additional groups, such as nurses or patients. The number of members and contacts were limited due to limited project funding, but still the major stakeholders were represented in the group.

6.3 The Core EHR project case study

The project included a number of workshops with vendors and users throughout 2007. I was facilitator for the workshops and technical project manager. The project team consisted of members from both KITH, and Trondheim municipality, the project owner. One of the results was the development of a message standard for communication between the EHR systems that was based on reusable components (KITH 2007b). This basis provided a new way in which to work with the standards for the vendors. It was regarded as a positive development, but it also required major changes in the EHR implementations from the vendors in the first implementation phase.

Requirement specifications for the client modules in the vendor EHR systems were also developed. The vendors were provided with funding based on the same model as used in the ELIN projects (Christensen 2009).

The core EHR was tested in the Trondheim municipality, but the pilot was not extended to other municipalities, as was intended. The main challenge of the projects was the need for coordination with other projects and national initiatives. The project depended on interaction with the national ePrescription project, which was significantly delayed. The Directorate of Health also decided to start a national core EHR project. It was decided that the national project should have a wider scope than the initial core EHR project. This project was also delayed and was only recently started in the autumn of 2011. The results and experiences from the first Core EHR project have been used in the new project. Examples of a broader use of the core EHR systems are the following: of the sharing of individual plans for chronic patients to support continuity of care; the summarizing of patients' contacts with health care providers in different organizations to get a quick overview of the patient history; and the use of core EHR information that includes important diagnoses, allergies and contact information in acute care.

The interviews with the users showed that the introduction of the Core EHR system required that all of the partners adjust their documentation practices to fit with other actors' needs and that this adjustment could be a future challenge for the deployment of such systems. Further research on sociotechnical implications on deployment of Core EHR systems was suggested.

Validity

The project was not implemented in full scale. As a result, experience with the project was mainly limited to a pilot in one municipality. Additionally, the interviews with the users were conducted in only one municipality, but this was also one of the largest Norwegian municipalities. Other municipalities were still involved in the project group and provided input to the project specifications. All of the national vendors were involved in the specification work.

6.4 The National Survey of Deployment of Electronic Referrals

Response rate

A total of 23 (82%) of the forms were returned, including the forms from all of the largest hospitals. The forms were filled out by different types of personnel, but most of the respondents were either responsible for units in the hospital with a special responsibility for collaboration departments or were project managers for collaboration projects.

Use of electronic referrals

A total of 16 of the 23 HAs did not use electronic referrals; however, they were very optimistic about the future roll-out process, and 16 of them predicted that they would send 75-100% of their message volume electronically by the end of 2010.

Challenges

With respect to challenges, the answers differed substantially, and there did not appear to be an evident answer to the problem of the slow deployment of referrals. The answers also differed from region to region and from hospital to hospital. Some of the answers were the following:

- It is not evident that the costs related to the introduction of electronic referrals can be justified by the benefits.
- The hospital can receive referrals, but the GPs are not sending them. Some hospitals assume that it is easier and more in-line with work activities for the GPs to use paper.
- It is difficult to integrate the new functionality of electronic referrals into the hospital's EHR system, and the hospital awaits new technical solutions.
- The hospital does not want to have a mixed solution of electronic and paper referrals and awaits that more GPs are willing to start sending electronic referrals.
- Work processes must be changed at the hospital, and decisions about changes are needed but have not been made.

Why are electronic referrals less used than electronic discharge letters?

It was also difficult to obtain a clear view of the reason why the deployment of electronic referrals was slower than that of discharge letters. The answers were mixed, but the answers that "the hospital has not given as much priority to electronic referrals" and that "electronic referrals were not as much requested by general practitioners" were the most common.

Referrals and changes in the workflow

A total of 13 of the HAs had performed a systematic mapping of the trajectory of referrals in the hospital. Then, 17 of the HAs planned (or had already implemented) changes in the internal workflow based on the introduction of electronic referrals. Some of the hospitals also commented that they wanted to perform changes in the internal workflow independently of the introduction of electronic referrals. Two of the HAs commented that they had recently started to use a new module in the EHR system with which they could electronically follow referrals that had been received at the hospital. Three of the HAs commented that they had started the introduction of electronic referrals with electronic scanning.

Practice consultants

Many of the HAs (17) had GPs working in part-time positions as practice consultants at the hospital and had issues that were related to collaboration. One of the hospitals introduced practice consultants as early as 1995, and another in 2001. The remaining 15 hospitals started to employ practice consultants between 2005 and 2007.

Some comments on the practice consultant's role in relation to electronic referral projects were the following:

- "We use them as ambassadors"
- "They are important in pilot projects for electronic referrals"
- "They work with guidelines for collaboration together with the specialist in the hospital"

One of the HAs also provided information about a project that the practice consultants were involved in, of which the focus was on the quality improvement of referrals. The practice consultants had made checklists that should be followed when the GPs filled in the referral form. The intention was to measure whether there were any changes in the referral quality after the checklists were used.

Two of the HAs had employed practice consultants in 2006/2007 but had ended the project. No reason for this scenario was given.

Contact for additional information

The HAs indicated that they seldom contacted the GPs to obtain additional information on the referrals. One of the HAs commented: "We do not ask for additional information. It is easiest for us to schedule the patient for an appointment at the outpatient clinic and do all the necessary tests there". Only two HAs indicated that they had to contact the GPs in more than 25% of the cases.

Open feedback

The questionnaire gave the responders the possibility of providing open feedback on issues that were of special concern to them. Many of the hospitals addressed the question of optimization of the work flow related to their own internal handling of electronic referrals. This scenario includes

scanning of the paper referrals to be able to handle them digitally in the EHR system and the introduction of modules in the EHR system that could support the secretaries' and specialists' work processes when handling electronic referrals. Some of the larger hospitals also wanted to replace the message-based solutions with a web-based solution with which they can require more input from the GPs. The standardized electronic referral has, thus far, been relatively open, and the structure of the referral has been based more on bilateral agreements than on rigid controls.

The hospitals that had employed practice consultants answered that they used them actively in the electronic collaboration process. I did not ask why some of the HAs did not have practice consultants or why two of them no longer had them at the hospital. This question could have provided useful feedback. The present study provided a good basis for further work, and I decided to obtain more information from the hospitals and GPs at an early stage of my work.

Additional survey data

The interviews have specifically been used to supply the survey information that appeared to be of special interest or for areas in which information was lacking.

Interview with the GP:
The GP spoke freely about issues that were related to the use of electronic referrals. She was a pilot user and had had access to the electronic referral module for two months. Some of the most interesting points that were raised by the GP were the following:

- Overall, the GP was positive toward the use of electronic referrals.
- The GP had already collaborated electronically with a group of private specialists from 2007-2008. To a large extent, the GP was satisfied with this communication solution.
- The GP used 15 minutes each day to answer questions from patients by email. Even if the GP was not paid to offer this extra service, the GP felt that it was satisfactory and well worth the time spent. The alternative was making phone calls.
- The secretaries and the GP assumed that they would spend less time in personal contact with patients when electronic referrals become used all of the time. This assumption was made because of the large number of phone calls made by patients wanting to know when they were scheduled for an appointment and the status of their referral. Shorter processing times for referrals would also result in fewer requests.
- The GP did not want to spend time choosing a specialist for the patient even if the patient in theory has a free choice of the service provider. The GP sends the referral to the closest hospital. If the patient is dissatisfied with the choice, he or she can call a national number to obtain help with selection of hospital.
- The addressing of electronic referrals is confusing. The GP was used to send referrals to a named MD at the hospital. This system has now been changed, and the referral should be addressed to one of several receiving units. The challenge is to choose the correct receiving unit, and the GP felt uncertain about what would happen if he or she sent it to the wrong address.

Interviews at the hospital:

The primary goal of the patient logistics project was to decrease the time that the patient must spend at the hospital and, accordingly, to reduce the hospital cost per patient. The logistics project was concentrated toward more effective logistics, making the patient stays as short as possible and keeping the costs low. Other project objectives were to enhance the quality of the referrals from the GPs, obtain more information from the patient before admittance to the hospital, and reduce the number of consultations at the outpatient clinic before surgery. The project manager commented that "Even if the GPs can misinterpret hernias, the same thing can also happen at the outpatient clinic" and suggested that new trials utilizing direct referrals could again be conducted as part of an effectivization process. To attempt to improve the quality of the referrals, a collaboration with the vendor of the Norwegian Medical Handbook (Grimsmo 2006) was initiated. The intention of this collaboration was to provide specialized referral templates for the GPs or guidelines that were linked to symptom groups. A work flow analysis of how referrals were handled internally was performed. As part of the effectivization process, the ward scheduled to receive the patient would contact the patient by phone shortly before the appointment to be certain that as much information as necessary could be gathered and double checked with the patient and to assure that the patient understood all of the necessary instructions.

The hospital also contacted the vendor to develop a new module of the EHR system that was intended to be used to follow-up with the referral internally at the hospital. The intention was that the paper referral would be scanned and then passed on electronically between the different actors who needed to have access to the referral. As a step in the process towards obtaining a full electronic record, the hospital had already introduced the scanning of electronic referrals in 2007. This introduction had caused additional work for the wards because scanning was time consuming (technology was immature) and medical secretaries had to scan the referral twice: first when the referral arrived and then a second time after the specialist had made an annotation on the paper referral. For wards where internal handling of the referral in the EHR system had not yet been introduced, the referral was not scanned until the specialist had made the annotations. Two wards had started to use the electronic module for internal handling of the referral in the EHR system. This development was still in an early stage, and the module did not work for all of the wards because their internal routines differed.

It was said to be a challenge that the hospital had EHR and patient care systems (PCSs) from different vendors. Administrative information is maintained in the PCS, while clinical information is kept in an EHR. This division means that waiting lists are updated in the PCS and that letters to the patient are also sent from the PCS. Both systems need to be considered when the work flow for electronic referrals must be improved.

One of the interviewed coordinators at the ward was reluctant to give the GPs more freedom with regard to booking patients directly for day surgery without first being admitted to the outpatient clinic for evaluation. She meant that the GPs were not competent enough: "We had a pilot project where the GPs were allowed to book appointment to hernia surgery. It was several occasions where the patient was admitted to the hospital, and the hernia could not be found. The GPs are simply not competent to do this". The representative from the hospital administrative staff claimed that the same thing would also happen for many patients who come from the hospital's outpatient clinic and that the ward would be more focused on misinterpretations from the GPs

than on any internal misinterpretations. The coordinators stated that the quality of the referrals differed substantially between GPs. This difference included both the length of the referral and the type of information that was provided.

The hospital had employed practice consultants, but none of them were presently working at the two wards that were contacted. This absence was said to have resulted from a problem in getting someone from primary care to actually do the job and a problem in receiving funding for the work.

The surveys vs. the interviews

To a large extent, the input from the interviews corresponded with the impression from the surveys. The interviews were specifically employed to supply the survey information that appeared to be of special interest or for areas in which information was lacking. The hospitals are motivated to provide solutions that can facilitate the reception of referrals, but it is also evident that they would like to benefit from new possibilities that electronic referrals can more easily provide as possibly easier access to more extended information from the GPs.

The hospital administration staff was looking for ways to make patient stays at the hospital as short as possible, and electronic referrals with more detailed and updated information regarding a patient's condition can be valuable in this respect.

The specialists at the wards also saw that there was a potential for putting more controls on the information that the GPs deliver to the hospital. Instead of "unreadable" paper referrals, they saw a potential for more detailed and specialized referrals. This scenario could also potentially provide them with more information that could be used for research purposes. The interviews indicated that even if some practice consultants were employed by the hospital, they were missing in some specialties. This situation was reported to be caused by a lack of funding.

The GPs were also concerned with the quality of the referral, but they did not necessarily understand the specialist's and the hospital's needs. When the GPs get paid according to the number of patients that are treated, it is no surprise that the GPs are reluctant to use solutions that could imply an additional workload for them. It is important for them that referrals can be produced from the information that is already present in their EHR system and sent electronically with as little manual effort as possible.

Validity

My experience with the questionnaire was that not all of the questions were equally useful in terms of feedback. As an example, the category 1-25% was too wide because many of the responses fell within this interval. It would have been more useful to further differentiate this percentage range, for example, with the intervals 1-10% and 10-25%. Questions for which the response ranges were found to be too wide were removed from the analysis.

One of the main challenges was to obtain the appropriate person to fill in the forms. It was requested that the forms should be filled in by managers who had clinical responsibility, but some of the forms were filled in by collaboration project managers or, in a few cases, by the ICT

managers. This change could influence the quality of the answers because some of these respondents, such as the practice consultants, may have limited knowledge about the questions.

The survey sample group was relatively small, but 23 out of 28 health authorities answered the surveys. The responses may have been biased if many of the larger hospitals did not participate or if responses from an entire region were missing. The larger hospitals handle a much larger number of referrals than the smaller HAs and have more complex internal organizational structures. Special attention was paid to obtaining responses from all of the largest hospitals, and hospitals who did not supply the forms were contacted again. In the end, all of the largest HAs responded to the survey.

6.5 The case study at HOSPA

The GPs were generally positive regarding the use of electronic referrals and preferred to use them if they had the option to send them electronically instead of via paper.

The only GP who did not send electronic referrals to HOSPA had not tested the system but had only heard from someone else that it was "difficult to use". Even if the decision support was available only for a few diagnosis codes, the GPs also sent referrals that were related to all types of diagnoses. With a few exceptions, all of the GPs used the decision support system.

The GPs said that they felt more confident about which patients they should refer to specialized care and which cases they were expected to handle at a local level when they used the decision support function. The decision support was also said to be useful when communicating with the patient and documenting why the case was not referred to specialized care. Phimosis in young boys was mentioned as one example.

Some GPs also found it useful to have guidelines regarding which test should be analyzed prior to writing a referral: "The guidelines are very useful as a checklist. Then I know that I have not missed out on something that is important for the specialists to know".

There were also GPs who said that the number of tests/procedures that were requested exceeded what should be included in the GPs' daily work tasks. Some GPs claimed that the hospital wanted to move too much of the work load from specialized to primary care and that the suggested guidelines were still too detailed. As an example:"I think some of these procedures are very tough for the patient and you really need a very good indication to do them. I think it should be the specialist's responsibility to request them."

On the other hand, there were GPs who questioned why the hospital could not allow them to conduct direct booking of "simple" surgical procedures without the need for an appointment at the hospital's outpatient clinic. They referred to the fact that many private specialists admitted patients for knee procedures without having an evaluation appointment first an introductory contact and that the patient could be spared a long waiting time and sick leave from work.

The GPs had been involved through their representatives in the project. The GP's representatives in the project team noted that it was important that the system should not require more time to be

used for the referral process than before the system was introduced. The GPs were mostly positive toward the manner in which the hospital had handled its relations with them during the design, development and pilot phase of the system.

Most GPs indicated that the level of the decision support was not too detailed. The GPs could also decide by themselves if they wanted to adhere to the guidelines or not. They said that this choice was a big advantage because they did not have to stop if the requested information was missing. "We appreciate that the specialists have accepted that they cannot ask for information that is nice to have. If we shall use the guidelines, they have to be short and to the point."

Even if the GPs had been in direct contact with the practice consultants, they stated that they trusted them as their representatives.

Many of the interviewed GPs had a good relationship with HOSPA either because they had worked there themselves or because they had had a long-term relationship with HOSPA and had trust that they offered high-quality services. In theory, patients in Norway have a choice regarding the hospital they are referred to, but in practice, both GPs and patients select the local hospital as their first choice unless the waiting lists are exceptionally long. This scenario is in accordance with experiences that Green et al. (Green, McDowall et al. 2008) found when they asked patients about their use of the Choose and Book system in England.

On the other hand, HOSPA had a reputation for long waiting lists for patients who were referred to the Gastroenterology department. One of the main reasons why HOSPA had chosen Gastroenterology as one of their pilot wards was that they wanted to provide the GPs with better services from this department and hopefully attract more patients who were currently handled by private specialists. During the pilot period, this strategy did not appear to work. The interviewed GPs still referred many of the patients who did not require acute surgery at the hospital to private specialists. The interviewed GP stated that this pattern mainly resulted from the long waiting time for the patient. They did not have any objections to the quality of the services from the hospital; however, improved possibilities for electronic collaboration and the access to decision support did not make them change service providers as long as the waiting times were longer.

The decision support system did not align well with all of the GP's work processes. Some GPs write referrals after the patients leave the office, and the decision support system would then be available too late in the work process because access to it is obtained at the time at which you enter the referral module and write the ICPC code.

The current version of the system offered a very limited number of guidelines. The GPs wanted to have access to guidelines for more specialties. The existing general guidelines should also be connected to more than one ICPC code.

Limitations

The evaluation of whether the decision support system has had any effect on the quality of the referrals that are sent to the hospital was not part of my PhD work. A separate evaluation of the quality has been performed by the clinicians, but the results are not yet published. Preliminary results indicate that it is difficult to see any changes in the quality at this stage of the project.

Validity

The interviewer can influence the responses of the interviewees based on the way in which questions are asked and answers are interpreted. The interviewees were told that I was a PhD student and that I also worked at KITH. I attempted to be very open and allowed the GPs to talk freely about the themes that I needed to address. The GPs appeared to show little interest in my background and were more interested in bringing their comments to the responsible actors at the hospital. My impression of the GPs is that they had strong opinions and were very honest about the tasks that they expressed. In some GP clinics, there were large differences between the opinions of one GP compared to another. I attempted to be objective in my analysis of the data and used nVivo as a support tool.

6.6 The GP's National Reference Group case study

A possible model for the further development of EHR systems in general is illustrated in figure 10. This model is based on my experiences from the project.

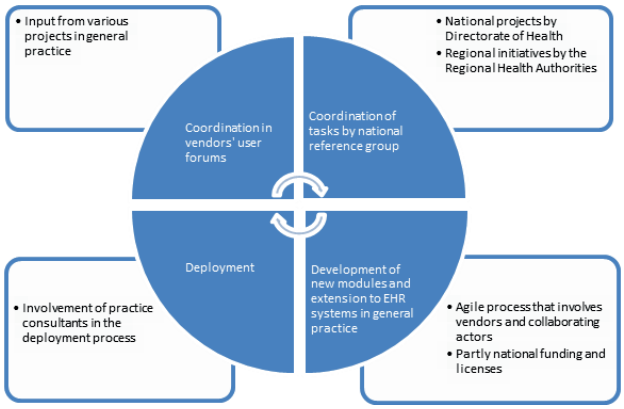

Figure 10: EHR development in primary care, (Heimly 2011)

Recommendations for development:

- Requirements from local projects and users are discussed and prioritized in user forums.
- The GP's national reference group coordinates and prioritizes tasks with national projects and works to obtain funding.
- Vendors develop new functionality in collaboration with GPs, practice consultants and other collaborating actors.
- Practice consultants actively participate in the deployment of new functionality.

Validity
Other models for how the GPs can influence national projects and processes may exist, and I have not performed a comparison or evaluation of the other alternatives. The suggested model is based on the experiences of the ongoing project from this case.

7. Discussion and implications

The main contributions of the thesis are summarized in this chapter. These contributions are related to the following research questions:

Q1 What are the status of and needs for electronic collaboration in the health care sector in Norway?

Q2 How can practice consultants influence the development and deployment of electronic referrals at a local level?

Q3 How can general practitioners influence the national ICT strategy processes and the national electronic collaboration projects?

Q4 How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

As stated in chapter 1.5, I have had a sociotechnical focus of my work, based on three aspects:

4. The interplay between users and technology
5. The different views of the collaborating actors
6. Regional and national perspectives

This has been influenced by my previous work with the national EHR-project and the Orbit project. I also observed that hospitals had both technical and organizational challenges related to the deployment of electronic messaging in the ELIN project (Heimly 2008a).

The focus of my work has not been on isolated technical issues but rather on the interplay between users and their collaborative solutions. I have also addressed how national bodies, vendors, clinicians and developers can influence the development and deployment of collaboration solutions in the Norwegian health care sector.

Tables 3-6 provide as overview of the findings related to Q1-Q4 and indicates which actors these findings can have implications for. It can be useful for the different actors to be aware of the findings in relation to strategy work and planning of new projects. Some of the findings are already known to the actors, but still need to be more focused.

Paper	Paper name	Research question number	Data collection activity
P1	Status of electronic referrals in 2009	Q1	DC1
P2	The Coordination Reform and the need for collaboration	Q1	DC2
P3	The Role of the Practice Consultant in Cross-Organizational Electronic Collaboration in the Health Sector, IEE CBMS 2010	Q2, Q4	DC4, DC5
P4	The General Practitioner in the Giant's Web	Q3	DC6
P5	Clinical guidelines as decision support	Q4	DC5
P6	Consent-based access to Core EHR	Q4	DC3
P7	How can the Locales Framework be used as Basis for Design of Collaborative Systems in Shared Health Care	Q4, Q2	DC1, DC2, DC3, DC4, DC5, DC6
P8	Step by step, Climbing the stairs from the introduction of electronic health records to electronic collaboration	Q4, Q2	DC1, DC2, DC3, DC4, DC5, DC6

Table 2: Research Questions and their relation to papers

7.1 Q1. What are the status and needs for electronic collaboration in the health care sector in Norway?

The first two papers are the basis for the present research. They provide an overview of the status of electronic referrals in European countries at the time that my PhD work began show the gap between the need for electronic collaboration to support the coming Coordination Reform in Norway and the current status. After the papers were written, this PhD work was supplemented by a short status update of some of the projects that were considered to be most relevant in the initial review (see chapter 2).

The review (DC1) showed that the deployment of electronic referrals in Norway and other European countries was also slow.

As seen from a sociotechnical perspective, there have also been challenges regarding resistance against future changes in work processes and a shift in work tasks between actors in primary and specialized care. National projects in the Netherlands, England and Denmark have been directed towards more involvement of the patient in the referral process and more decision support for the GPs than in Norway. The introduction of these referral systems was followed by national incentives. An update of the status in 2011, see chapter 2, showed that although there were still challenges and the processes had been slower than expected, the deployment appears to be accelerating.

The systems in Denmark (Medcom 2008) and the Netherlands (Bal, Mastboom et al. 2007) appear to be more successful than the Choose and Book (Dixon A 2010) system in England. Zorg Domain in the Netherlands originated as a regional system while the other two systems were

targeted for national use from their initial inception. One of the main challenges for the deployment of referral systems in Europe has been that many countries do not have EHR systems in full use both in GP offices and in hospitals.

The Coordination Reform study (DC2) showed that collaboration solutions to support shared care and the intentions of the Coordination Reform are, to a large extent, lacking. There is a significant gap between the number of requested collaboration services and that of the currently available services. The collaboration between health workers should be improved, and patients should also be supported by services such as access to referrals and having a choice in their service providers.

As a basis for my further research, the papers show that there is a strong need for improved electronic collaboration in Norway. The current degree of use of EHR systems is good, but the diffusion of the collaboration systems that rely on the EHR systems is slow, and many new collaboration systems are still needed.

My contribution to Q1

My contribution to Q1 has mainly been based on the review of experiences from larger projects in Norway and other European countries, and from my participation in the Coordination reform study where I worked together with stakeholdes in national electronic collaboration.

Q1 and implications for actors						
	Re-searchers	National authorities	Vendors	Regional HA and hospitals	General practi-tioners	Paper
Decision support and booking are commonly used in other countries. There is a need for further development in Norway.	x	x	x	x	x	P3
Electronic patient collaboration is limited in Norway and should be improved.	x	x	x	x	x	P3
National incentives and coordination have been used in other countries and could be considered in Norway.		x				P1, Ch 2.9[4]
Changes in work processes and tasks should be grounded by involved actors.	x	x		x	x	P1
The Coordination Reform is not supported by necessary electronic collaboration solutions, which should be improved.	x	x	x	x		P3

Table 3: Overview of the findings related to Q1 and indication of which actors these findings can have implications for

[4] Chapter 2.9, Electronic referrals outside of Norway

7.2 Q2. How can practice consultants influence the development and deployment of electronic referrals?

DC4 and DC5 have addressed the practice consultants' role in collaborative projects.

Practice consultants can be seen as boundary spanners who can bridge general practice and specialist services in health care and who have a special interest in collaboration related to boundary objects.

Figure 11 Practice consultant and specialist, photo: Kai Dragland

The national survey, DC4, showed that an increasing number of hospitals employ practice consultants and involve them as boundary spanners in collaboration projects. Interviews with general practitioners also indicate that they trust that the practice consultants do a good job on behalf of all of the GPs in relation to collaboration issues, but they also want them to spend more time in direct contact with general practitioners. The interviews from the HOSPA case study indicate that practice consultants can help to support the deployment process of electronic collaboration systems in the Norwegian health care sector.

Practice consultants can play an important role as boundary spanners in the process of improving the quality of guidelines and documentation and in the development of new and innovative systems for handling electronic collaboration across organizational borders. The interviews from HOSPA and the national survey support this conclusion. On the other hand, the interviews indicate that GPs often do not have the time to communicate much with practice consultants, but the GPs trust that they can be spokespeople for themselves in processes regarding the design and development of electronic collaboration systems.

The GPs who are willing to work as practice consultants are often very experienced and have a large amount of knowledge regarding the work processes in primary care, which they can share with specialists at the hospital. They will also be given the possibility of spending time with specialists and will also be in a better position to understand their needs and to provide feedback to their colleagues involved in general practice.

These observations also correspond very well with Levina and Vaast's (Levina and Vaast 2005) three conditions for becoming a boundary spanner-in-practice:

1. The boundary spanner must become a legitimate, but possibly peripheral, participant in the practices of both fields. The boundary spanner must negotiate between the involved practices, which requires an understanding of these practices.
   The practice consultants spend time working with collaboration issues, both in hospitals and in general practice.
2. The boundary spanner must have legitimacy, not only as participants but also as negotiators on behalf of the fields whose interest they represent. This means that he or she must have the symbolic capital to make others see the agent as being capable of reshaping the practices of the fields for which the boundary spanner serves as a representative.
   The practice consultants are experienced GPs who have been working in general practice for many years and who have extensive experience with collaboration challenges. This scenario makes them highly trusted by their own colleagues in primary care. They are employed by the hospital, and their positions have been established as a result of a high-level administrative decision at the hospital.
3. The boundary spanner must develop an inclination for the work. This may not only come from expecting rewards in the local fields, but also from the interest of developing new skills.
   Practice consultants often state that they find their work to be very interesting and that they see that their work can truly facilitate a change for both the clinicians and the patients.

My contribution to Q2

My contribution is based on the questions I asked about Practice Consultants in the survey (DC4), my semi structured interviews from HOSPA (DC5), prior knowledge that I had from working together with practice consultants at KITH and information that was gathered during the writing of papers 3, 4, 7 and 8.

Q2 and implications for actors						
	Re-searchers	National authorities	Vendors	Regional HA and hospitals	General prac-titioners	Paper
Practice consultants should be involved in the design of modules and systems that support the GP's work processes regarding electronic referrals			x	x	x	P3, P4, P8, P7
Practice consultants should be considered for the role of pilot users in electronic referral projects			x	x	x	P3
Practice consultants could be used actively in anchoring processes for deployment; examples include developing guidelines, establishing meeting arenas, and providing information to the GPs				x	x	P3
Practice consultants can take part in processes to make agreements about the content and structure of information that should be transferred, e.g., referrals		x		x	x	P3, P4, P8, P7

Table 4: Overview of the findings related to Q2 and indication of which actors these findings can have implications for

7.3 Q3. How can general practitioners influence national strategy processes and national projects that involve them as collaborative partners?

The first EHR projects started at a local level. An increasingly fewer number of the products that the GP vendors develop are intended for a local market. The vendors need to know that their products can be sold and deployed to many customers. There is a contradiction between the local needs and the potential for moving into a broader market. The vendors are also short of money for the further development of their systems, and most of the development is related to national projects and national requirements.

The EHR reference group is an initiative from the GPs to attempt to gain more influence on national projects and strategies.

The reference group can be regarded as the Community of practice as defined by Lave and Wenger (Lave and Wenger 1991) because the members satisfy three characteristics:

1. They have a shared domain of interest: they are all GPs and are specifically interested in how their EHR systems and collaboration systems can be improved to better support their work processes.

2. They are members of an active community: they attempt to help each other with feedback on issues in which they share a common interest. These issues can range from questions regarding requirements for connections to the Norwegian Health Net to problems with backup routines or the structure of referrals.
3. They are practitioners: these members are very active in their own online forum. They serve on hearings for national bodies and select participants for national work groups. They organize group meetings that are open to all of the members of the community in in conjunction with other national meetings or conferences. This process reduces travel costs. They also have a webpage on which they update information about activities that they participate in.

Membership in this group is open to all GPs who want to participate. The only requirement is that new members must introduce themselves when they join on the internet. They must explain who they are and whether they have any specific interests that may be of interest to the rest of the group.

The reference group has, thus far, come up with a list of more than 30 action points related to desired improvements of their EHR systems. Some of these action points are general and broad (decision support) while others are more concrete and specific (suggestions for improvements in the interface of a communication module). Some of the action points only have implications for the systems that involve general practice, while others are related to collaborations with external actors. The action points have further been structured through Kartleggingsprosjektet (KITH 2011).

Figure 12 The vendor's role, (Heimly 2011)

The GPs have emphasized that they want to have seamless integration with the collaboration systems from their EHR system, and they possibly want to reuse structural elements from other actors' EHR systems.

The Directorate of Health and some larger regional and national projects have used the group as a resource. Because the group depends on volunteer participation, the Directorate of Health has also provided some funding for administrative tasks, such as help with the organization of meetings, meeting participation for core members and report writing.

The proposed model in figure 12 illustrates how the reference group works today. The experiences from the first year during which the model has been used in practice have been positive, but the GPs still struggle with the fact that they have limited funding for the vendors. Ellingsen and Røed (Ellingsen and Røed 2010) also emphasized this need: "IT may be beneficial

to channel resources e.g. money and personnel, to the users and make sure to allocate sufficient time for their activities that are related to integration. In turn, the users may choose to channel some of these resources to the vendors for specific assignments."

So far, the reference group has obtained some funding for their activities from the Norwegian Medical Association. The Directorate of Health has provided some funding for the administrative support from KITH and a pilot project in which information about medication can be retrieved from unstructured discharge letters that have been sent electronically from the hospital to the GP**.** The resource group should be used actively by national bodies, regional health authorities and vendors.

My contribution to Q3
I helped the GPs to structure their suggested action points and requirements in a document that can be used as a basis for national bodies and vendors (KITH 2011). I have also participated in work to attempt to help the GPs obtain national funding for some of their activities, and I have acted as one of their contact people to the Directorate of Health. I have suggested the future model in figure 12 for collaboration between national bodies based on the experiences.

Q3 and implications for actors						
	Re-searchers	National authorities	Vendors	Regional HA and hospitals	General prac-titioners	Paper
National authorities should consider funding for the national EHR reference group		x				P4
A national reference group can be used as a resource for national activities (e.g., strategy work, national projects, hearings)		x		x		P4
A national reference group can be used as a resource group in regional processes				x		P4
A national reference group can be used by vendors as support for maintenance and further development of EHR and collaboration systems			x			P4
A national reference group can possibly be used as a resource group for research on EHR and collaboration systems	x		x			P4
A national reference group can be used by the GPs as a coordinator for input to national authorities, vendors and national projects		x	x	x	x	P4

Table 5: Overview of the findings related to Q3 and indication of which actors these findings can have implications for

7.4 Q4. How can a basis for more widespread electronic collaboration, including referrals, be established from a sociotechnical perspective?

The four papers P5, P6, P7 and P8 provide input for work with strategies for widespread electronic collaboration. The first two papers provide a basis from projects that have been established at a municipality and at a medium-sized hospital. P7 shows how a CSCW framework can be used in the design of collaboration systems, and P8 describes how the implementation of a collaboration system can be a stepwise process. The other papers (P1-P4) also provide a basis for answering this question.

The Core EHR project and implications for vendors and regional projects

The Core EHR project (P6) was originally started as a project within one municipality and was extended to become a joint project between Stavanger, Tromsø and Trondheim, allowing all major vendors to be included. This process was challenging because it implied that many actors needed to be involved, namely vendors of EHR systems for hospitals, municipal care centers and

primary care centers all needed to update their systems. Even if the changes were not large, it was a time-consuming process because the systems had different release dates, and the vendors had different priorities.

The Core EHR project and implications on national initiatives

The core EHR system was piloted in the Trondheim municipality, but it was not spread to other municipalities as intended. The main challenge was the need to coordinate it with other projects and national initiatives. This project depended on interactions with the national ePrescription project, which was significantly delayed. The Directorate of Health also decided to start a more general national Core EHR project. It was decided that the national project should have a wider scope than the initial Core EHR project. The results and experiences from the first Core EHR project were handed on to the new project, which was also significantly influenced by the work and project members from the first project who participated in the preparation of the new project. This project was initiated in autumn 2011.

The Core EHR project and implications for the health workers' work processes

Based on the first Core EHR project, it was concluded that the overall effects of the new systems for the work practices of various health care providers must be evaluated. The core EHR system provides a gateway for secure electronic communication regarding medications between diverse parties and technological platforms. While this system ensures a common location for the documentation, it remains to be seen how the various actors will need to adjust their documentation practices in terms of timing their activities as well as tailoring their information to ensure usability for the various end users. Lessons from the research within CSCW (Computer Supported Cooperative Work) indicates that work processes will need to be continually revised when new technology provides new functionality in interactive contexts. Collaborators will need to develop new patterns of interaction through the new media. These requirements also form the basis for further work with the general Core EHR. The Summary Care Record (SCR) is a similar centrally stored health summary that was created from a patient's GP record. It contains details regarding medication use, allergies and adverse reactions and will be available for National Health Service (NHS) staff in the UK. Based on an evaluation of SCR, Greengalgh et al. (Greenhalgh, Wood et al. 2008) concluded that a successful introduction of SCRs will depend on the interaction between multiple stakeholders from different worlds (e.g., clinical, political, technical, and commercial) with different values, priorities, and work methodologies. They meant that the program's fortunes appeared to depend on the ability of change agents to bridge these different institutional worlds, align their conflicting logics, and mobilize their implementation. In the Norwegian context, the practice consultants could be used as change agents.

The Core EHR as a boundary object

The Core EHR system uses standardized elements as a basis for communication between the involved actors. This standardization ensures the communication of structured information, but end users, with the help of their own her system, will still need to "translate" the information into a form that is suitable for their own uses. For example, a medication that a doctor prescribes could be substituted by the pharmacy with an equivalent drug that they have available, which could result in two pills with another name instead of the original one depending on the strength of the pills. The home care nurse may need to alter the timing of dispensing the pills from that specified by the doctor's instructions to accommodate their own or a client's timetable.

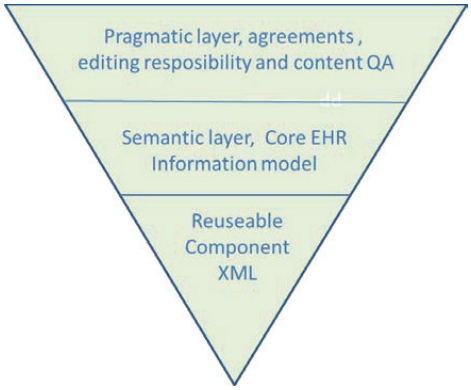

Figure 13: Core EHR based on Carlile's framework

The legal aspects of who has the overall responsibility for the content of the Core EHR system must be considered. The intention of the Core EHR project was to allow the GP to have this responsibility and to allow him or her to have a quality assurance check of all of the new items that are added. If new elements are added without any check for quality and consistency with the information that is already included, there is a severe risk that the Core EHR system will not correctly display the patient's current medication list. Agreements of how the responsibility for the Core EHR system should be managed must be made. An example of how the Core EHR system can be seen in relation to Carlile's framework (Carlile 2002; Carlile 2004) is shown in figure 13.

The decision support project and implications for the local hospital

The current version of the system offers a very limited number of guidelines. The GPs wanted to have access to guidelines for more specialties. The existing general guidelines should also be connected to more than one ICPC code.

The initial intention of the project was to improve the quality of referrals. Although the GPs appear to be satisfied with the system, a comparison of a set of referrals before and after the introduction of the referrals did not reveal any significant differences in the quality. The development and maintenance of the guidelines require that resources for this work must be provided by the hospital. Based on a lack of quality improvement, the hospital has not seen any possibilities for extending the project into 2011.

There is also a need for extended collaboration about information that is additional to the original referral and requests around the status of the referral. The next step will be to extend the system with a dialogue-based service, where GPs and specialists can communicate about the patient cases. HOSPA appears to be successful with their deployment of electronic referrals despite the fact that many Norwegian hospitals struggle with their deployment. All of the GPs except for one said that they preferred to use electronic referrals when they could. Traditional electronic messaging has been the first step, followed by a slow move toward the solution supported by decision support.

Based on the feedback from the GPs, it appears that the focus on electronic referrals has led to a situation in which electronic referrals are also preferred when decision support is not available.

The decision support project and national or regional implications
Because of the cost of the development and maintenance of the guidelines, regional or national collaboration regarding guideline development should be considered. Many of the GPs also mentioned that they should have a closer collaboration with developers of the more general guidelines, such as the developer of the Norwegian Medical Handbook (Grimsmo 2006).

There can be small differences between projects that are adapted by the users and projects that fail. In this project, it appears that a rather slow but stepwise approach has been successful. The technical solution supports most of the GPs' work processes in a valid and acceptable manner. The involved actors also appear to trust each other, and most of them see the benefits of using the electronic referrals. The use of practice consultants as boundary spanners and active representatives in the project could also have led to a situation in which the GPs felt a stronger sense of ownership and commitment to the system.

The decision support project and implications of the GPs' work processes

The clinical guidelines were developed through a process in which the GP representatives in the projects and the specialists came to an agreement about the level of detail and structure of the guidelines. In this process, the guidelines can be regarded as boundary objects. From the first attempts in which the specialists wanted the guidelines to be very rigorous and detailed, the tradeoff resulted in a requirement that restricted each guideline to be a list of a maximum of five points. The use of the guidelines was voluntary and gave the GP freedom to decide how they would be used without a need for input controls. They said that this advantage was a large benefit because they did not have to stop if the requested information was missing.

The first guidelines were regarded as a starting point, and the plan has been to update the guidelines on a regular basis based on the feedback from both the specialists at the receiving end and the GPs.

The decision support did not align equally well with all of the GPs' work processes. Some of the GPs wrote referrals after their patients left the office, with the result that the decision support would be available too late in the work process

The GPs' representatives in the project team noted that it was important that the system should not require more time to be used for the referral process than before the system was introduced. This observation is in line with findings in a study from the UK (Christensen 2009) in which the GPs were reluctant to use the Choose and Book system because of the additional workload.

The GPs said that they felt more confident about which patients they should refer to specialized care and which cases they were expected to handle at a local level when they used the decision support function. The decision support that was also reported to be useful is communication with the patient to document why the case was not referred to specialized care.

Some GPs found it useful to have guidelines on which tests should be analyzed prior to requesting a referral; however, there were also GPs who stated that the number of tests/procedures that were requested exceeded what should be included in the GPs' daily tasks.

Some GPs claimed that the hospital wanted to move too much of the work load from specialized to primary care and that the suggested guidelines were still too detailed. On the other hand, there were GPs who asked why the hospital could not let them conduct direct booking of "simple" surgical procedures without the need for an appointment at the hospital's outpatient clinic. At least one GP referred to the fact that many private specialists would admit patients for knee procedures without an introductory contact at the outpatient clinic, and the patient could be spared a long waiting time and sick leave from work.

Use of the Locales framework

Paper 7 shows how the Locales framework can be used to support the design of systems for collaboration in the Norwegian health care sector. The example in the paper can potentially provide an indication of how the same framework can also be used to support further design of a collaboration system in the health care sector. Paper 7 provides an example of how the work that has been performed in relation to the first survey, the review and the HOSPA case study, can be analyzed by means of the framework. The following 5 pages shows the example from paper 7.

The five aspects of the framework (namely, foundations, civic structure, individual views, interaction trajectories and mutuality) are thought to capture the complexity of reality and can potentially help to position concepts within a coherent framework.

These aspects support the following:

- Analysis of work in complex situations
- Design of systems motivated by an interactional rather than a technological perspective

These aspects all provide different perspectives or ways of understanding the locale in question, but they are also often interdependent and are partly overlapping. The locale is based on the relationship between the social world and its use of space and resources.

Foundation

The primary social world of interest in the Norwegian health care system as seen from a collaboration perspective case is comprised of the health workers, the patient's relatives and the patient, who all share the common goal of providing/receiving better health care services closer to the patient's home. More focus on this common goal will hopefully lead to a process that changes from a situation in which small groups of people work together in locales at a local level (e.g., hospital, nursing home or general practice) to a situation where actors from the different locales work together in a new locale that is shared (see figure 14). The locales to the left are social worlds that are related to physical spaces such as buildings, while the locale to the right could be related to a virtual domain.

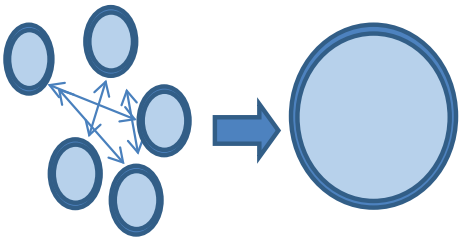

Figure 14: Shift from Communication between Locales to Collaboration in One Locale, (Heimly 2010a)

Infrastructure

The highway for information sharing and exchange in the Norwegian health care sector is available to many actors in the sector. The Norwegian Health Net (NHN) is a closed, secure high-speed network that connects almost all of the hospitals and GPs. An increasing number of municipalities with nursing homes and home care offices are also connected to the net. One of the main uses of the health net is broadband communication between the hospitals, but an increasingly greater amount of information is also exchanged between hospitals and primary care centers. The main challenge thus far has been that a very limited number of services are available. The Norwegian health net is a technical infrastructure, and it is only to a limited degree an information infrastructure. The development of end user services has thus far mainly been the communicating parties' responsibility. The new health reform will suggest that the NHN shall be owned by the government and not the 4 Regional Health Authorities that currently operate the hospitals. The intention of this suggestion is to emphasize that the health net is available for all of the actors in the health care sector. The new NHN will also gain an extended responsibility for adding new services to the net. This action will also include collaborative systems as a national core EHR system. When new collaboration services that are intended for a national market are designed, it is essential to plan how these services should be related to this infrastructure. Requirements that follow from the National cooperation architechture must be addressed. The Directorate of Health is responsible for the development and maintenance of this architecture.

Civic Structure

Norwegian health care workers are obliged to use health records to document their patient contacts. Complaints from the patients about procedure failures and maltreatment are becoming increasingly more common; therefore, documentation of the actual treatment and procedures that are implemented is becoming increasingly important.

Legislation in many countries does not permit doctors at different levels in the treatment chain to share medical information. Information sharing requires patient consent, and consent-based systems are not always practical in daily use. The legislation in Norway is changing very slowly and is still quite restrictive. The introduction of a proposal for a law change that will permit sharing of core EHR information based on consent has led to heated debates in the media. Patients

can be very reluctant when it comes to how much information should be shared, and patient organizations can be more concerned with the possibility that sensitive information could get into the wrong hands than the possibility for better treatment if the clinicians have access to the right information at the right time.

The "Code of Conduct for information security in the health care, care, and social services sector" (Helsedirektoratet 2010) is the basis of an information security policy for all of the organizations within the sector. The intention is to ensure secure interoperability for all of the organizations that comply with the regulations described in the Code. The Code of Conduct was developed by representatives from the sector. The code covers aspects of information security that are regulated by Norwegian law. In some instances, the Code of Conduct defines more stringent rules than the law itself.

The Code consists of a main section, guidelines and 45 thematically arranged best-practice routines, or "fact sheets", which provide guidance on procedures such as how to perform risk analyses and how to establish back-up procedures etc. Together, the main document, the guidelines and the fact sheets aim to cover both the crucial and basic elements of information security, as well as the more peripheral and remote elements. These elements should be addressed when designing collaboration systems.

Individual View

The purpose of the information: Documentation for you, me or other actors?

Medical information that is produced for use in one context can be used by other actors in a different context. When a clinician writes information into an EHR, this information could be used by several actors and from different points of view:

- Documentation as a part of the internal work process that covers the treatment of the patient at the hospital. The patient will typically be treated by many doctors and nurses during different shifts, and accurate information about the patient's medical condition, medication and treatment plans must be available on a "need to know" basis.
- Documentation for the patient. The patient is becoming closer and closer to a customer, and requests access to his or her own EHR. Many patients even have bedside access to their own EHR. As a result, the EHR documentation must be written in a language that is understandable to non-experts.
- Documentation for the next level in the treatment chain.
- The GP requests EHR documentation that is important for initiating further treatment when the patient returns to primary care. Information about current medication when the patient leaves the hospital, the outcome of the hospital stay, scheduled appointments with the specialist and expectations for further treatment in primary care is important. The GP would typically not be interested in details regarding surgery or a treatment that was given during the hospital stay, and it is important that essential information for the GP does not "drown" in information that is only needed and intended for hospital internal use.

- Documentation for reporting to national registers, e.g., a "patient register" with administrative information about hospital stays or quality assurance registers such as the Norwegian Cancer Registry.
- Documentation for reimbursement. In Norway, hospitals are paid by the government according to how many patients and they treat on an annual basis.
- Documentation for research purposes.

A basis for the information that is registered in the EHR is defined by national standards and legislation, but the definition and use of the individual views is also highly dependent on the involved actors' common understanding of each other's needs. It is, therefore, important to involve representatives from groups that are secondary users of the information in the early design stages. In the Norwegian context, this involvement will imply boundary spanners such as practice consultants and communities of practice such as the national EHR reference group, patient organizations and nursing or medical associations.

Interaction Trajectories

Trajectories in health care must be mapped and analyzed at different levels. The initial national survey of the hospitals showed that many of the hospitals had performed a substantial amount of work on making internal patient trajectories more effective to reduce costs. For example, they ordered extensions from the vendor for modules in the EHR system to support the internal handling of referrals, and they initiated actions to improve the quality of the referrals from the GPs.

The Coordination Reform will influence current trajectories that involve patients and actors in municipal and specialized care. One of the intentions with the reform is to provide the patient with more health services at the municipal level and fewer services in specialized care. This scenario will lead to a need for more supervision from specialists and increased collaboration among health care providers. In addition, the patient and his/her relatives can be more involved in taking care of health-related issues.

Many patients will need community care services after they leave the hospital. This type of requirement could include home care services, a short or long stay at a nursing home, or a rehabilitation service. The nurses at the hospital will attempt to have these services organized before the patient leaves the hospital, and the municipalities will require adequate information regarding the patient's needs and the time of dismissal from the hospital as soon as possible. Figure 15 shows different actors who need information about the patient in a shared care process.

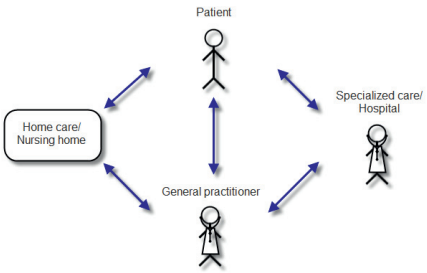

Figure 15: Shared care, (Heimly 2010)

The Coordination Reform study showed that the ICT support for the realization on the new reform, to a large extent, is missing.

Mutuality

Awareness in collaborative health systems
Souza et al. (Souza and Redmiles 2007) focused on the problem of "To whom should I display my actions, and whose actions should I monitor"? These questions are highly relevant in shared care because health workers need access to health information that is updated by many parties. Awareness of new content that is added is important but should not be too disturbing in the daily work process. GPs that have been involved in a Norwegian core medical chart project (Heimly 2008b) were very concerned that they might be disturbed in their daily work by flags or alarms that pop up on their screens or interrupt their work processes. They did not want be informed immediately when medication was prescribed for their patients by other doctors; instead, they wanted to check for this type of change in a list on a daily basis. The GPs were also not interested in information about treatments that were prescribed by the specialist for a short span of time (for example, antibiotics for treating a specific type of infection).

Enough, but not too much information
The GPs also want to have access only to the information that they need and not to all of the information that could possibly be available about the patient. A better structure of the medical record and better possibilities for the filtering of information may help to solve this problem, but unfortunately, most of the EHR information is solely a large cluster of free text. Important information can be hidden in the hospitals' EHR information, but the GP does not want to have the responsibility of searching through all of this information in search of something that he or she does not even know is present. Instead of sharing all of the information, doctors appear to be more satisfied with obtaining the information that they need transferred, such as an abstract, or with obtaining access to some core information about the patient such as current medications, diagnoses, allergies and updated demographic information.

Trust

Trust is important in collaborative work, but it is a challenge for health care workers, as for most other people, to trust others' recommendations. This concern can appear to be especially difficult when they interact with people whom they do not know very well. As an example, the waiting list coordinator commented during an interview that a project in which GPs could refer patients directly for hernia surgery was terminated because there had been several cases in which the hernia could not be found when the patient was admitted to the hospital. The specialists at the hospital meant that the GPs were not qualified for choosing patients for surgery. In an interview with a representative from the hospital managers later, it was claimed that a "missing hernia" would often be the case even if the patient was admitted via the hospital's outpatient clinic and that the problem was not necessarily related to the GP's competence. The practice consultants can be seen as boundary spanners who can bridge general practice and specialist services in health care. In the study from HOSPA, the practice consultants were said to be trusted by both the specialists and the GPs.

The Locales framework and the relation to the Boundary framework

The Locales framework and the Boundary framework are both examples of tools that could be used to aid the design of collaboration systems in health care. They are not replacements for more

traditional methods and development tools, but rather can be important supplements in the design phase of collaboration systems because they focus on the interplay between actors in different organizations and those involved in developing various technical solutions. As the survey and the HOSPA case show, the technical solution must work, but the collaborative aspect of how the different actors are involved in the design and how they come to know about each other's needs is also important.

My contribution to Q4

My contribution to Q4 has mainly been based on my work with four papers 5, 6, 7 and 8, but the other four papers are also relevant. Based on these papers I provide recommendations for how to design and deploy electronic collaborations in the health sector that can be supported from a sociotechnical viewpoint.

Q4 and implications for actors						
	Re-searchers	National authorities	Vendors	Regional HA and hospitals	General practi-tioners	Paper
GPs might benefit from decision support that is based on guidelines from specialists.		x	x	x	x	P5, P8
It is hard to see any quality improvement for the hospitals from decision support in the GPs' EHR systems.		x		x		P5
GPs require that new functionality to support collaboration must be integrated into their EHR systems.			x	x	x	P5, P8, P2
GPs trust practice consultants as their representatives in the design of collaboration systems.			x	x		P6,P5, P7,P8
GPs are reluctant to use systems that require them to use more time or resources unless they have an incentive.		x	x	x		P5, P6,P7, P8
GPs and specialists may have a different view on, and different use of, information that is transferred (e.g., a discharge letter or referral). Common understanding and agreement are needed.	x	x	x	x	x	P5,P6, P7, P8
The design and deployment of collaborative systems can benefit from the use of frameworks such as the Locales and Boundary frameworks to ensure that sociotechnical aspects are addressed.	x		x	x		P7, P8
The stepwise introduction of new functionality in electronic collaboration appears to be feasible.		x	x	x		P8

Table 6: Overview of the findings related to Q4 and indication of which actors these findings can have implications for

8. Conclusions

The main contributions of this work are the following:

- C1. Recommendations for how practice consultants influence the development and deployment of electronic referrals (Q2)
- C2. Recommendations for actions that national bodies can take to make more reliable plans for the development and deployment of ICT systems that support collaboration (Q1, Q3, Q4)
- C3. Recommendations for how clinicians can influence national ICT strategy processes and national electronic collaboration projects (Q3)
- C4. Suggestions for how to design and deploy electronic collaborations in the health sector that can be supported from a sociotechnical viewpoint (Q4)

This thesis in based on the status and need of health care in Norway. The results from my work are not necessarily transferable to other countries because many factors such as the organization of the health sector, incentive models, legislation and the installed base of information systems differ substantially between countries. This work is based on electronic referrals as an example, but most of the implications in the previous chapter are related to electronic collaborations in general and should also be considered during the design and deployment of electronic collaboration systems, especially the systems that are intended for national deployment.

Future work that could be of interest would be to research how new actor groups, such as patients, could become involved in national design and deployment processes of collaboration systems that are intended for their use. Examples include the patient portal, extensions of referral services in which the patients themselves can have an active role in the online choice of the service provider and the communication with the specialist, and the summary EHRs or improved services for communication between the patient and the GP. The patient's requirements may influence other actors (e.g., specialists and GPs), work processes and benefits, and one of the challenges will be to ensure that new systems can be deployed to and used by all of the actors that need to be involved.

Other activities of interest could be to look further into how new ICT services can support the GPs and specialists in fulfilling the requirements imposed by the Coordination reform and how deployment of these services can be accomplished. Electronic collaboration between the GP and the specialist is a vital part of this interplay. Electronic clinical guidelines, decision support and referrals that are tailored for each medical specialty are potential examples of added functionalities that could influence the involved actors' work processes.

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Appendix 1: Orbit News

Orbit

Etter initiativ fra en gruppe primærleger i Orkdalsregionen er det etablert et prosjekt for å bedre samhandlingen mellom ulike deler av helsetjenesten. Prosjektet er godt forankret ved OSS, fylkeskommunen og på kommunalt nivå.

Prosjektet er fra og med sommeren 1999 delfinansiert med midler fra KRD, i tillegg til at det er knyttet opp mot prosjektet Midt-Norsk helsenett som bidrar med ressurser til etablering av den tekniske infrastrukturen. Prosjektet har også stor nytte av samarbeidet med NTNU.

Det legges stor vekt på å forankre prosjektet i brukermiljøene.

Et viktig mål for prosjektet er å få gode elektroniske epikriser ut til primærlegene, men de arbeides også for å få sendt røntgensvar, henvisninger og laboratoriesvar over Midt-Norsk Helsenett.

Mer informasjon om Orbit og MNH på MNHs nye web: www.mnhelse.net

Faglig prosjektleder
Steven Crozier
Frøya legesenter
7260 Sistranda

Telefon: 72 44 95 00
E-post: crozier@online.no

Administrativ prosjektleder
Vigdis Heimly
KITH
Sukkerhuset
7489 Trondheim

Telefon: 73 59 86 02
E-post:vigdis.heimly@kith.no

Prosjektleder Steven Crozier

Samarbeid om praksiskonsulentarbeidet

Det er planlagt at praksiskonsulentordningen skal settes i drift ved OSS fra 1.12.2000. Praksiskonsulentordningen vil bli etablert i samarbeid mellom Orbit og KS. Mer informasjon om dette samarbeidet og organiseringen av praksiskonsulentordningen vil bli sendt i løpet av to uker.

Møteserien for kontortjenesten er igangsatt

Første møte ble avholdt 25. september hvor ca 20 motiverte deltakere møtte opp. Hovedintensjonen med møtet var å få igangsatt en prosess for å bedre samhandlingen mellom sykehus og primærhelsetjeneste også på kontorsiden.

Julemøte 22. November!

Det blir et felles møte med både kontortjenesten og legene på Bårdshaug Herregård 22. november hvor vi regner med å kunne feire at de første elektroniske epikrisene er mottatt hos primærlegene. Møtet blir etterfulgt av middag. Menyen blir pinnekjøtt. De som vil ha lutefisk istedenfor pinnekjøtt må gi beskjed om dette ved påmelding. Orbit spanderer middag, men ikke drikkevarer. **Påmelding innen 10. november til KITH ved Jorun Nebb. (jorun.nebb@kith.no eller på telefon 73598600)**

Midt-Norsk helsenett er på vei ut til primærlegene

De første primærlegene som blir knyttet opp mot MNH tilhører Orkdalsregionen. Ruter er bestilt til pilotlegekontorene.

Husk møtet 25. oktober!

Neste møte i møteserien holdes på OSS onsdag 25. oktober. Følgende tema blir tatt opp:

1. Status for innføringen av MNH og arbeidet med elektroniske epikriser.
2. Status på arbeidet med omorganisering av legevakt
3. Sykehusepikriser og legevaktepikriser, videre arbeidet med innhold og omfang.
4. Hvordan knytte henvisninger og epikriser mot en problemorientert journal?

Arbeidet med innholdet i epikrisene er hovedtema for dette møtet. Vi håper at flest mulig har anledning til å delta i dette viktige arbeidet, og at både sykehusleger og primærleger har anledning til å bidra.

Det blir enkel bespisning. Møtene er åpne for alle, også de som ikke har deltatt på de første møtene.

VEL MØTT!

Appendix 2: Questionnaire for the survey

Electronic collaboration

1. How large is the proportion of electronic referrals compared to the total number of referrals that you receive?

0	1-25%	25-50%	50-75%	75-100%

2. What do you expect this proportion to be by

   The end of 2008?

0	1-25%	25-50%	50-75%	75-100%

   The end of 2009?

0	1-25%	25-50%	50-75%	75-100%

   The end of 2010?

0	1-25%	25-50%	50-75%	75-100%

3. Has the HA performed any systematic work on the internal information flow regarding the internal handling of referrals?

Yes	No

If yes, then describe briefly (3-5 lines).

4. If electronic referrals are used:

Have they caused any changes in the internal work processes?

Yes	No

Are any changes in work processes planned? If yes, please describe these changes (3-5 lines).

5. Do you have practice consultants?

Yes	No

What is the number of practice consultants and what are their work tasks?

When was the practice consultant system implemented (year)? _____-

Do you engage the practice consultants in electronic collaboration projects?

Yes	No

If so, briefly describe their role (3-5 lines).

6. What do you see as the main challenges regarding the deployment of electronic referrals?

If preferred, several challenges can be described. Prioritize from 1 to the number of challenges. 1 indicates the highest priority.

Reason	**Priority**
The HA has not had sufficient funding to prioritize electronic referrals	
The HA can receive electronic referrals, but the GPs do not send them	
Want to wait for new technology	
Lack of integration between the receiving module for referrals and the electronic health record system or the patient care system	
Internal addressing and organization of the referral reception do not work well	
The introduction of electronic referrals will not lead to any short-term economic benefits for the hospital	
Other reasons; describe below (3-5 lines)	

7. The deployment of paper referrals is slower than the deployment of electronic referrals. What are the main reasons for this difference? One or more reasons may be given. Prioritize from 1 to the "number of reasons".

Reason	Priority
The HAs have given lower priority to the work with electronic referrals than to all of the electronic discharge letters	
The need for organizational changes is greater	
The need for changes in the systems in the receiving end is larger	
The GPs have not requested electronic referrals to the same extent as discharge letters	
Other reasons (3-5 lines)	

8. Do you plan to make changes in the process of referral reception?

Yes	No

If yes:

If so, are the changes related to the introduction of electronic referrals? Describe the changes briefly.

9. What is the proportion of referrals for which you do not have sufficient information from the GP in the referral and you need to call back?

0	1-25%	25-50%	50-75%	75-100%

Appendix 3: Interview guide for the general practitioners

- What were your expectations regarding the introduction of electronic referrals?
- What advantages or disadvantages do you see from the introduction of electronic referrals in the short and long term?
- How have you been involved in the project?
- What have the largest challenges been thus far?
- Have you had any formalized collaboration with the specialists at the hospital during the interactive referral project, and if so, what type of collaboration?
- Have the practice consultants been involved in the project, and if so, what has your contact with them been?
- Have you had any collaboration with the other pilots regarding the project, and if yes, what type of contact?
- Which actors do you send referrals to?
- What is the volume of the referrals that you send to the different actors?
- Has the introduction of electronic referrals influenced your work processes?
- How does the use of electronic referrals influence your communication with the patient?
- To what extent do the patients want to choose a specialist, and how can this choice eventually influence your use of electronic referrals?
- Do you use the "good referral," and if you do, then what are your experiences with the use of the recommendation?
- Would you recommend the use of specialized referrals, and if so, why?
- What are your experiences with interactive referrals thus far?
- What suggestions do you have for improvements in the system?
- Who are responsible for the daily operation and maintenance of the electronic collaboration services in your practice?
- Do you have any suggestions for the improvement of operation and maintenance procedures?
- What would you do differently if you started the project again?

Papers

Paper 1

Electronic referrals in Health Care: A review

Medical Informatics Europe (MIE) 2009

Electronic referrals in healthcare, a review

Vigdis Heimly [a,b,1]
[a] *Norwegian University of Science and Technology (NTNU), Trondheim, Norway*
[b] *Norwegian Centre for Informatics in Health and Social Care, Trondheim, Norway*

Abstract. This paper gives an overview of projects completed on the topic of electronic referral in healthcare. The first referral projects were based on standardized EDI-communication. The same basis is still used in many projects, but these are slowly being replaced by web-based solutions with possibilities for decision support and booking. The time from initiation of the first services to high volume use seems to be very much related to how well the new solutions fit with the general practitioners (GPs) and specialists work practices, and if there are obvious benefits for the communication partners. High volume national services seem to require both political support and pressure. Some of the projects have not paid enough attention to sociotechnical approaches.

Keywords. electronic referral, booking, sociotechnical approaches, review

Introduction

A search for scientific papers related to the development of electronic referral systems, has revealed that there has been few evaluations and reviews of such projects. Most related reviews cover telemedicine services more in general as [1-3].

The main sources for this paper have been scientific papers, but reports and interviews with people who work with referral-related projects have also been used as a basis. Many of the papers described planned or recently started projects, or projects that covered a limited number of users or few medical specialities. The main focus in this paper is on projects that seem to be of national interest and have been ongoing for some time, but some promising newly started projects are also mentioned. It has been a challenge that many projects are not regarded as research projects, and limited documentation about them is available in English. Most projects in this review originate from Northern-European countries, but it is likely that there are contributions from other countries available in other languages than English. The findings in this paper are still thought to be representative of trends in general.

[1] Corresponding Author: Vigdis Heimly, NTNU, Department of Computer and Information Science, Sem Selands vei 5-7, NO-7491 Trondheim, Norway, E-mail: vigdis.heimly@idi.ntnu.no

1. Referral projects

1.1. Electronic referrals in Finland

One of the first referral projects was initiated at the Helsinki University hospital in 1991 [4]. Two other projects were also well established early: One of them was a system for developed countries [5]. The other [6] was established in the Oulo region in Finland. All these three systems involved e-consultation in addition to referral.
According to the users, the e-referrals saved time and improved the quality of the documentation.

1.2. The MedCom-projects in Denmark

The first Danish project started in Vejle in Fyn County in 1995 [7] and was based on EDIFACT-messages. Although Denmark started early, electronic referrals have had a slower uptake then most other health messages. 41% of the referrals were sent electronically in 2004, and 63% of the referrals were sent electronically in November 2008.

In June 2008, a solution called the "referral hotel" [8] was introduced and rolled out in full scale over a period of three months. The GPs fill out the electronic referral in their EHR-system and send referrals as EDI-message to a repository. The patient will then contact the specialist for appointment by phone or email. The specialist retrieves the referral from the hotel by means of a standardized EDI-message. The patient can also ask the patient to send the referral directly to a named specialist.

MedCom reports that all GPs and specialists in Denmark currently have the access to the system, and that it is widely used. Use of the hotel is compulsory for the GPs. The development and management of the referral hotel is paid by the hospital regions.

1.3. National Health Service (NHS) and the "Choose and Book" system, United Kingdom

The Choose and Book system gives the patient the opportunity to book an appointment a hospital or clinic either when the patient is at the GP's office or the patient can book and/or change the appointment later. Choose and Book is a nationwide system, and can be used for booking appointments at any hospital funded by the NHS. It is also possible for the patient to check the status of the booking.

It took two years to get the first million referrals through the system, but in less than a year another 4 million referrals were through the system. According the NHS, 15,070 referrals were sent daily in October 2007, representing 45 percent of the NHS referral activity from GPs to specialist care.

1.4. ZorgDomein, Netherland

ZorgDomein is a commercial web-based product that includes clinical guidelines and information about the services that are offered. The project started in 1997 and the first implementation was available for use in 2001. The solution supports standardized cooperation between GPs and hospitals. Twenty-five% of the regions, and 2000 GPs

used the system in 2008. The GPs can choose from available services in the region and refer patients to the chosen hospital.

1.5. Electronic referrals in Norway

Some Norwegian hospitals provide solutions for standardized referrals, and all the GPs Electronic Health Record (EHR)-systems are prepared for sending electronic referrals. Less that 25% of the referrals were sent electronically in January 2009. The basis for electronic referrals has been EDI-messages based on XML [9].

A national electronic booking project was established in 2002. The idea was that GPs in cooperation with the patient should book appointments at any Norwegian hospital. The use of the system has been very limited.

In parallel with the deployment of traditional EDI-messages, web-based solutions are planned at AHUS hospital, UNN in Tromsø, Bærum hospital and St. Olavs hospital. These projects have a basis in the Norwegian messaging standards but represent a migration towards new solutions. The project at UNN is called the One-STOP project [10]. The objective of the One-STOP project is to study if standardized electronic referrals based on guidelines combined with electronic booking can decrease waiting time for out-patient surgery. The project at AHUS is a web-based referral solution linked to work with new national guidelines from the Directorate of Health. The project is intended to be deployed within the whole South-East regional health authority, which is the largest of the four regional health authorities in Norway. The project is linked to other projects at Bærum hospital and St. Olavs in hospital in Trondheim. The project in Trondheim has a focus on development of recommendations for referrals within different specialities. The intention is to combine the referral solution with the EHR-systems, decision support and clinical guidelines.

2. Discussion

When electronic referrals were introduced, many were hopeful that there would be large economic savings and many benefits for the users. Hasman [11] concluded that the use of standard messages for exchanging information between hospitals, GPs and pharmacies could result in relatively large savings. Harno et al [12] examined the clinical effectiveness and costs of the referral process in the Peijas region in Finland. They also concluded that an electronic referral system between secondary and primary care would improve clinical effectiveness, lower direct costs, increase productivity and be cost-effective. A study with focus on quantifiable cost benefits in Denmark [13] also concludes that widespread adoption of electronic referral would be of significant benefit to the national economy.

The uptake of electronic referral systems has been much slower than expected. A survey [14] among the GPs gave a number of reasons for the limited use of Choose and Book. According to Eason many patients did not want to choose, the system did not provide the information they needed about clinics, it took a lot of time to work through options with patients and the GPs were worried about the security of patient information put into the system.

Even if many of the first initiatives, including the Norwegian ones, had a focus on organizational development, they have probably not paid enough attention to the

interrelation between technology and its social environment. According to Berg [15], sociotechnical approaches aim to increase understanding of how new information systems and communication techniques are developed, introduced and become a part of social practices. Berg suggests that the largest challenge for the sociotechnical approach is how to interrelate the nature of health care work with the characteristics of formal tools.

The intention behind the Norwegian booking system was to reduce the number of cancellations and give the patient in cooperation with the GP the option of freely booking between hospitals. The system was intended to be used for cases when it was not necessary to send a referral, but the GP could book appointments in accordance with guidelines from the hospital. It turned out that the specialists did not want GPs to book appointments without them being able to prioritize the patients according to information from the referral letter. The GPs found it time consuming to search for ”the best” hospital together with the patient. Many of the patients did also not want to be involved in this process themselves, and wanted the GP to make the decision. The presence of the patient, also made it difficult not to book available timeslots, ie to book on behalf of the patients preference and not in accordance with the hospitals priority policy [16].

Reponen [6] assumes that their roll-out process of electronic referral was successful because they used a special team consisting of primary care physician, University physicians and a nurse in charge of education and planning of e-service usage. They worked at all the clinics and were involved in planning customized workflow changes. The rollout process was described as demanding because many actors were involved.

A series of semistructured interviews with involved partners in ZorgDomein [17] showed that the project positioned itself in a controversy on the role of primary vs secondary care diagnostics. The project could imply a new distribution of tasks between GPs and medical specialists, and it was also a concern that the role between diagnostic centres and hospitals could be changed.

If the technology cannot be seen as useful for the parties involved, the solution will not work in practice. When it comes to electronic referrals and booking, it is essential that the parties involved see what is beneficial for the patient and society as a whole, as opposed to how the system affects themselves as an individual. This is a challenge in a market-driven system where specialists, hospitals and GPs get paid according to the services they provide. The GPs would not like to spend extra time together with the patient to try to find the “right” hospital and make a booking, if this responsibility can be given to the patient instead. The Danish referral hotel transfers the responsibility for making an appointment from the GP to the patient. ZorgDomein and Choose and Book also provide the same option. In Norway, politicians, patients, and GPs would probably be skeptical to use this kind of solution, seen in light of prior experiences

3. Conclusion

Ongoing referral projects differ a great deal. There is not likely to be one best solution that proves to be beneficial for all countries. Legislation, organization of the healthcare system and cultural differences are factors that may influence the choice. Electronic referrals seem to have a large potential for economic savings as a whole, but it takes longer time than expected to realize this potential. Denmark seems to be

successful with a short roll-out period for the referral hotel, but for most of the systems examined, the deployment process has taken much longer than first expected

Electronic referrals are requested in many countries, but it is likely that the roll-out process still will be slow, and that there will be a migration towards new solutions. In some countries booking of specialist services will probably also be more accepted and more easily fitted within work processes than booking at hospitals, because hospitals in many cases would like to have control over the priority between different patients

Many of the new referral projects provide possibilities for booking in combination with clinical guidelines [18] and streamlining the referrals according to the particular needs for different specialities and/or local hospital/region needs. Sociotechnical aspects are often underestimated. If the new solutions cannot easily be a part of the clinician's work processes, the roll-out process will probably be slow.

Whatever solution is chosen, it will probably be necessary to have support for the project at a national level, and as part of a national strategy. Coiera [19] also states that strong political support is a key factor. Coiera recommends that Australia should start with just a few national clinic centers and after they have been successful, migrate to the rest of the health system.

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Paper 2

The Norwegian Coordination Reform and the role of electronic collaboration

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The Norwegian Coordination Reform and the Role of Electronic Collaboration

Vigdis Heimly[1,2] **and Jacob Hygen**[2]

[1] *Department of Computer and Information Science, Norwegian University of Science and Technology, Trondheim, Norway*
[2] *Norwegian Centre for Informatics in Health and Social Care (KITH), Trondheim, Norway*

Abstract
The Norwegian Government has identified electronic collaboration as an important tool to support an upcoming reform in Norwegian Health Care– the Coordination Reform. The goal of the reform is to prevent citizens from becoming patients and reduce the need for specialized care. The patients are also supposed to become more active in taking responsibility for their own health. The paper sums up the findings from a study that was done in order to get an overview of the status of electronic collaboration in the Norwegian health care sector today, and the challenges due to lack of such collaboration that can be seen in light of the coming reform. The work is based on the input from a reference group, meetings with potential users and national strategy documents. A situation analysis of eight trajectories that span primary and secondary care was performed. The main results from the work are summarized in a collaboration map. The map shows areas that need more focus in future development of collaborative ICT systems. The work shows that ICT-solutions supporting shared care and empowering the patient to a large extent are lacking. This is contradictory to the Coordination reform's intention of empowering the patient. The situation analysis reflects the status as of April 2010.

Keywords: Collaboration; Health Reform; Core EHR; Standards

1 Introduction

1.1 The Norwegian health care system

Primary care is the responsibility of the 430 municipalities. Most General Practitioners (GPs) work in private enterprises, in agreement with their local municipality. A major health care reform in 2001, led to the organization of the 81 Norwegian hospitals under 4 health authorities that are owned and supervised by the government. This means that the different actors that are supposed to participate in shared care across organizational borders, are financed by different sources.

All patients are assigned to **one** GP's patient list. All primary contacts with the health care system, except acute care, should be channelled through the GP. Most patients who are admitted to the hospital have been referred by their GP. When the patient has finished the treatment at the hospital, the normal procedure will be to return to primary care under the GPs responsibility.

The Norwegian health care system has obvious challenges that also are visible in other European countries with a public health system: The hospital administration wants to keep the patient stays as short as possible in order to reduce hospital costs. Patients who have finished the required specialized care at the hospital and are waiting for transfer to nursing homes, or are not well enough yet to move to their own homes, are filling up hospital beds. As people live longer due to improved health care services, more and more patients will need care in their elderly days. Many people are also rescued from a sudden death as early newborns or in traffic accidents, but may need specialist care for a long period.

A coming Norwegian health reform - the Coordination reform- is being implemented in 2011/2012. The

reform has focus on how the patient can be provided with more health care services in primary care, closer to their homes, and reducing the need for expensive specialized care. Economic incentives are an integral part of the Coordination Reform. Governmental funding will to some extent be channelled from the hospitals to the municipalities. The municipalities will then have to pay the hospitals according to the number of patients they refer to specialized care, and there will also be a high cost to pay for patients who have finished their hospital treatment, but occupy hospital beds until the municipalities are ready to receive them.

One of the goals of the health reform is also that electronic collaboration shall be a preferred future means of collaboration in the health care sector. This includes:

- Electronic collaboration between service provider and patient/user: Examples of systems are: electronic booking, on-line consultations/telemedicine and access to own Electronic Health Record (EHR).
- Electronic collaboration between all groups of health workers across organizational borders.

1.2 ICT in Norwegian health care

ICT has been used as a tool to support the Norwegian clinician's work processes for more than two decades. The first Norwegian EHR systems were used by GPs as early as in 1984 [1]. 98% of the GPs have had these systems in daily use since 2001 and EHR systems are also in use in all Norwegian hospitals. These systems started as administrative tools, but have over time emerged to be systems that support the clinicians in their daily work with patients. 95% of the municipalities have installed ICT systems to support administrative patient related work in nursing homes and home care, and 75% of the municipalities also use EHR systems as a support for nurses and doctors in community care.

The number of EHR system vendors is limited to 2-4 vendors in each system group (GPs, municipalities, hospitals). In addition to the traditional EHR system, the hospitals have specialized systems that are used by the different specialists or administrative staff. The larger Norwegian hospitals will typically have 50-150 of these systems. Examples of such system are: Laboratory systems, PACS, medical charts, operation planning systems, maternity ward system and intensive care system.

The electronic collaboration between the caretakers in different organizations has so far mainly been based on electronic messaging, but web-based solutions and systems that provide access to shared core medical information are also in limited use. Deployment of electronic messaging is of high priority according to the national eHealth strategy, but has been much slower than expected. This has proven to be more related to organizational challenges than technical barriers [2], but it is also shown that the deployment processes in health care in Norway are generally slower than expected [1].

The questions that we address in this paper are: To what extent do we have ICT systems that can support national health care ambitions, with special emphasis on the challenges related to the Coordination Reform? Where do we have "white spots" and where do we need to develop new systems?

2 Methods

The work was initiated by the Norwegian Centre for Informatics in Health and Social Care (KITH) and supported by Innovation Norway. The project team included three members from KITH and the Norwegian University of Science and Technology (NTNU). The work was mainly based on available project reports and national strategy documents. The group had additional meetings with the Norwegian EHR research centre and a project manager at one of the larger Norwegian Hospitals.

The project team was supported by an external reference group with members from:

- Innovation Norway
- The Norwegian Research Council
- Trondheim Municipality
- The Norwegian EHR Research Centre
- The Directorate of Health
- The Ministry of Health
- The Norwegian Centre for Telemedicine and Collaboration

The reference group had two physical meetings, and the members also participated actively in commenting on input from the project team. Based on the input from a reference group, meetings with users and available documentation, a situation analysis of six trajectories was performed. The main results are summarized in a collaboration map that provides guidelines to which areas needs more focus for future development of collaborative systems. The study was finished in August 2009. A supplementary study on Patient Communication was finished in September 2010.

3 Results

The collaboration map (figure 1) summarizes the current status of electronic collaboration in health and social care. The y-axis shows the main actors, and the x-axis shows the trajectories that involve the different actors. A more detailed description of the actors and trajectories is provided in the discussion chapter. For each collaborating actor, a colour code and number indicate to which degree the prerequisites of ICT-supported collaboration are present. That includes both standards and ICT systems to be used for collaboration. The figure does not show to what extent the available solutions are used in practice.

The numbers are used as a support to the colour coding, and are also used to indicate an answer between two numbers.

The collaboration map shows that the possibilities for standardized electronic collaboration are very limited in relation to preventive care, shared care, acute care and in relation to casual contact between patient and GP/dentist. Preventive care, shared care and the patient possibilities for administration of own health have been focused in the upcoming health reform, and it is very concerning that these trajectories so far seem to lack electronic collaboration support.

4 Discussion

4.1 Basic requirements for electronic collaboration

Electronic collaboration can be established by means of different communication media ranging from SMS messages to video-conferencing, and the use of shared repositories. Collaboration systems can be based on tailored standalone software or more standardized solutions that are intended for national deployment. There is already a large installed base of ICT systems in use in Norwegian health care. As the number of actors and systems has grown over the years, the need for standards has become more and more evident, and they are requested by both users and vendors. The Norwegian health reform in 2001 imposed the increased standardization of ICT systems and electronic collaboration solutions within each of the four regional health authorities. Ellingsen and Monteiro [3] have studied the consequences of standardisation at a regional level, and drawbacks can certainly be seen. When standards are used, it is important to recognize the sociotechical context that they will be used in, and that the actors that are involved in the collaboration must see benefits from use of the system in their daily work [4]. Deployment of EHR systems has been slow in Norway [1], but a similar pattern is also seen in other countries [5], [6], [7], [8], and must also be expected for new collaborative systems. Manual procedures are also likely to be kept in parallel with electronically based procedures because not all types of collaboration are suited for ICT-support [9].

The government requests that implementations of collaboration systems that use messaging should use the Norwegian Cooperation Architecture [10]. Basic requirements in this architecture are:

- All messaging traffic should use the national broadband infrastructure,
- The Norwegian Health Net.
- Only standardized messages should be used.
- ebXML framework should be used
- Application receipts should be sent for all messages.
- The vendor's message implementations should be approved by the Norwegian Certification Service at KITH.

Electronic messaging in Norway is mainly based on the use of CEN/TC251 standards for communication across organizational borders and HL7 standards for hospital internal communication. The hospitals' collaboration organization for ICT, National ICT, does also provide additional guidelines for development of systems in specialized care in their architecture document [11]. A collaboration architecture for web services is also available and should be used when feasible.

4.2 The actors that are involved in the trajectories in the study

Patients and relatives An individual can have many different patient roles from someone who visits the GP sporadically to get an immunization or preventive cancer checkup to chronically ill patients who needs access to specialized care services for long periods. A patient's relative may also be everybody from parents of children who are hospitalized to the children of elderly people in nursing homes. In Norway patients have a legal right to have access to their own health record. This right has today to be handled by requests for printouts of the EHR, as no on-line tools are available for the patient's access to the information.

Community care The municipalities have the responsibility for primary care in Norway. In line with the "Municipal Act", the municipalities should provide

Trajectory/ Actor	Medical colla-boration	Community care	Shared care	Acute care	Service and support functions	Preventive care	Public insuranse colla-boration	Casual patient contact with GP/dentist
Patient	1	1	1	1		1	1-2	1-2
Community care	3	3	1-2					
GP	2-3	3	1-2	1-2	3	1-2	3	1-2
Accident and emergency unit				1-2				
Health station	1-2					1-2		
Hospital	2	2	1-2	1-2	3	1-2	2	
Private specialist	2-3		1-2	1-2	2	1-2	3	
Pharmacy	1	1			1		2	
Dentist								1
Public insurance partner							3	
Hab/ rehab	1-2	1-2	1					
Lab/ X-ray	3				3			
Ambulance (car/boat/ air)				1				
Employer							1	

Figure 1: Collaboration map. The colour codes used are: Blank cells - Non relevant, 1 - Few systems with collaboration support are implemented. Standards are missing, 2 - Few systems with collaboration support implemented. Some standards are available, 3 - The most essential standards are available and several systems that can be used for collaboration are implemented, and 4 - Certified and standardized collaboration solution is commonly available.

necessary health services to all citizens who live in the municipality on a permanent or temporary basis". This includes preventive care, diagnostics, treatment, rehabilitation, care of elderly people and homecare services.

General Practitioners Since 2001, all citizens are assigned to one GP's patient list. The patient's GP is the gatekeeper to specialized care. The GP is the coordinator between the patient and the health care system and in power of referring to special health care services on behalf of the patient.

Accidental and emergency unit Accidental and emergency units shall grant all citizens high quality out of office hours and emergency services. It is a part of primary care, hence a municipal responsibility. These units are often located close to the hospital. Several municipalities may share the responsibility for one emergency unit. Emergency units have EHR systems, but have limited possibilities for electronic collaboration with other actors.

Health stations (Maternal and child centres) Health stations are the primary mechanism for preventive care, with focus on children and pregnant women. All immunizations for children are provided by the health station. Pregnant women will also come to the health station for regular checkups during the pregnancy.

Hospitals The vast majority of the hospitals are owned by the government and are organized under 4 regional health enterprises. A few private hospitals operate in agreement with the regional health enterprises. The hospitals have the responsibility for somatic care, psychiatry and drug rehabilitation.

Private specialists Private specialists are organized as private enterprises, in agreement with the public health care regarding refunds. They offer their services in competition with the public health system and as a supplement to the services hospitals offer if the capacity in the hospitals is limited.

Pharmacies These are private sector enterprises (747), except for the ones serving the hospital sector (33). The pharmacies handled 27,9 mill. prescriptions in 2006 and the number is increasing. Most prescriptions are sent to the pharmacies from the GPs.

Dentists Public dental services are under the direction of 19 regional authorities. The services cover children, young people, and adult groups with special needs. Services are also provided by dentists in private sector. Most dentists have electronic patient record systems.

Public insurance Norway has a public insurance scheme. Most of the people who live or work in Norway are mandatory members in the National Insurance Scheme, independent of nationality. Members of the National Insurance Scheme are entitled to retirement pension, disability pension and dependant's pension, as well as compensation for occupational injury.

Habilitation/ rehabilitation Habilitation and rehabilitation services are provided by hospitals, and by various private specialists (physio- and ergo- therapists, etc.). Rehabilitation and habilitation services may also be offered as homecare. Habilitation is a process of creating something that has not been there, rehabilitation, that of restoring something that was there and working to its formerly better functioning.

Laboratories/ X-ray These services are partly offered by hospitals, partly by private enterprises. To some extent there is a competition between private and public actors. This has led to a situation where the private actors often are market drivers in offering new services, also including electronic collaboration.

Ambulance services The ambulance services include car-, boat-, plane- or helicopter services that are part of the regional health enterprize's acute care outside of hospitals. The ambulance service needs to collaborate with several actors like police, emergency fire service, rescue groups and the emergency team at the hospital.

Employer The employer is a person or organization who hires one or more people to work for salaries. The employer should have a close collaboration with The Norwegian Labour and Welfare Service in order to adjust work conditions to prevent employees from getting sick, and to make it easier for employees with special needs to stay as a part of the workforce. The return from a sick leave period should also be adjusted to the employees needs.

4.3 The trajectories in the study

The trajectories that were regarded to be most essential for collaboration across organizational borders in health care by the reference group, are included in the analysis. These were:

1. Collaboration related to an event where the patient needs to be referred to specialized care – the medical trajectory
2. Collaboration related to the patient's use of services in community care
3. Shared care where a mix of services from specialized care and primary care are needed over time
4. Acute care
5. Collaboration regarding use of service and support functions like laboratory services
6. Collaboration in relation to preventive care

7. Interaction with the welfare system

8. Casual patient contacts with GP/dentist

The medical trajectory The standard medical trajectory includes the process from the patient contacts the GP and a need for specialized care is recognized, until the patient has finished treatment in specialized care and the responsibility for the patient is transferred back to the GP. Annually 2 million referrals are sent from GPs. 25% of the referrals are related to cases where the patient is admitted to the hospital immediately, while the remaining 75% results in a contact at a hospitals outpatient clinic or an appointment with a private specialist. The responsibility for the patient will normally be transferred back to primary care, when the patient has finished treatment in specialized care. The discharge letter will be sent to primary care from the specialist or hospital.

Status of electronic collaboration: EHR systems are available and in use both by GPs and hospitals. Standards for electronic referrals and discharge letters are specified. The required functionality for communication is specified and implemented by the vendors. Discharge letters are sent electronically by most actors, but the volume of electronic referrals is still low (less than 30%). Most systems are based on electronic messaging, but web-services are also used. It is a challenge that few hospitals can receive electronic referrals. Some nursing homes can receive discharge letters. Laboratory tests can be ordered from the GP's EHR system, and laboratory answers will be sent to the GP's EHR system both from hospital labs and private service providers. A national ePrescription system is developed and is in pilot use.

Further work: Further work should include deployment of electronic referrals between hospitals, more specialized referrals, further work with web-services and solutions for communication with patient and relatives. A public health portal should also be developed.

Community care trajectory Many patients will need services in community care after they leave the hospital. This can include home care services, a short or long stay at a nursing home or rehabilitation service. The nurses at the hospital will try to get these services organized before the patient leaves. It is important that these services are in place when the patient returns to primary care. The patient can often depend on the services for a long period. Many patients will also be readmitted to the hospital, and it will then be necessary to inform the service providers that the patient does not need services for a while. In order to avoid that patients have to be hospitalized longer than necessary, it is also important that the booking of these services is coordinated. It does not help if 5 of 6 services are in place, if the patient has to wait to leave the hospital until the last one is available.

Status for electronic collaboration: 65% of the nursing homes used EHR in 2008. At the same time 65% of the municipalities had started to use EHR, and 34% had introduced EHR in habilitation services. 6% of the municipalities have mobile solutions for home care and most of these use PDAs although research also has indicated that it is hard to document effects of these systems [12]. 36% of the municipalities are connected to the Norwegian Health Net. A national project, named ELIN-k, has been established by the Norwegian Nursing Association, The Directorate of Health and The Norwegian Municipal Organization in order to deploy electronic collaboration within and to/from community care. Standards for communication between hospital and community care have been established and are implemented in the EHR systems by the vendors. Partial funding for this has been provided by Innovation Norway. The use of these standards is limited at the moment, but is increasing. 5% of the hospitals were communicating electronically with the community care in 2008, but a growth to 46% is expected in 2010.

Many telemedicine projects have been initiated, but few are in daily routine use. Examples of telemedicine systems are systems where home carers can send photos of leg ulcers to the GP and specialist, mobile X-ray systems for use in nursing homes and in home care, and videoconferencing between hospital and health workers in community care.

Further work: Electronic collaboration within community care and between community care and specialized care is still limited and should be prioritized in the coming years. Some projects that involve patients and relatives have been initiated, but in general more focus on these issues is needed.

Shared care An increasing number of patients suffer from chronic diseases like diabetes, cancer, COPD and chronic heart related conditions. These patients will often require services from both specialized and community care, and it is important that all actors have access to updated health care information about the patient.

Status for electronic collaboration: Few electronic solutions that support shared care are in daily use today. Patient with chronic diseases have the right to have an individual plan that is used for coordination of the different task and services that are provided by the health workers. A plan coordinator in the municipality is usually responsible for the plan. Electronic individual plans were in use by 9% of the municipalities in 2008, and another 8% have planned to introduce electronic

individual plan.

The deployment phase of electronic individual plan has been slow. This is partly due to legislation, and the government's resistance against sharing of information across organizational borders, despite the fact that they have put pressure on municipalities in order to use the paper based version. It is an ongoing national process in order to change the legislation to make it easier to share information when necessary, but this process is slow, and the patients consent will be required.

Pilot projects where core EHR-information can be shared across organizational borders have been requested from many actors in the Norwegian health care sector. Patient summary information with an overview of the patient's contacts with different actors is also wanted. Sweden and Denmark have already implemented similar systems. National strategy projects and some initial projects have been initiated in Norway [13].

Patients with chronic diseases are only to a limited degree involved in taking care of own health by means of electronic collaboration. They often participate in support groups on the internet or search for relevant documentation, but they lack electronic services for collaborations with nurses, GPs and specialists. Access to their personal EHR and possibilities for supplying the EHR with their own data is often very limited.

Further work: More work is needed in order to establish systems where information can be shared among actors.

Acute care Acute care comes in to effect in emergency situations, when life is threatened and/or immediate medical/ambulatory assistance is required. Ambulance services will often be used in order to bring the patient as fast as possible to a location where specialized care can be provided.

Status for electronic collaboration: Acute care is supported by dedicated systems. However, EHR information, which often is critical for decisions to be taken under severe time constraints, can to a very little extent be exchanged between the actors in acute care, and the actors do not have immediate access to vital information collected in other EHR systems (medication, allergies, ...).

Further work: A planned national Patient Summary project is foreseen to give better support to acute care, but improved solutions for electronic collaboration between the actors in acute care are also needed.

Service and support functions The responsible person for treating the patient often require supporting services, as medication supply, laboratory examination and non-medical services such as transport.

Status for electronic collaboration: If the services are offered by the unit where the person who requests this information works, the access to relevant information is good. When the information is distributed across organizational borders, the presentation in the receiving end is often not adjusted to the receivers needs, and presentation will also be different according to which source the data is sent from. The same coding system for laboratory data is for example not always used. Laboratory answers are often sent electronically, but requisitions and referrals are still often sent by ordinary mail. Electronic requisitions are in limited use. CDs are still also commonly used to transfer X-rays. Requests for patient transportation are handled in a national ICT system. ePrescribing is not in daily use, but an ambitious project is going on, with development of standardized communication as an integral part.

Further work: Priority must be given to a standardized electronic exchange of radiology information. Deployment of the ePrescription solution will require significant efforts, but should be intensified with focus on both improvement of the technical solution and user involvement. User interfaces for handling of electronic collaboration should be improved in the EHR systems in primary care. Possibilities for tracing of requisitions and referrals should be developed.

Preventive care The Maternal and child health centres have the responsibility for health monitoring as well as immunization of the children until the age of 16. Pregnant women will also be in regular contact with these centres and the families will also have regular visits during the children school age. Pregnant women will always bring a pregnancy chart with updated information about her medical status to all appointments with the nurse at the health station, midwife, GP and the hospital ward.

Status for electronic collaboration: 50% of the Maternal and child health centres in the municipalities have EHR systems. Less than 20% of the health stations were connected to the Norwegian Health Net in 2008, and collaboration with other actors is to a very little extent handled electronically. Standards to facilitate electronic reporting of immunizations are developed, but not in use.

Further work: Maternal and child health centres should be connected to the health net, and standardized communication between the health stations and other actors like the GP, maternity ward at the hospital, school and the national registry of immunizations should be established. Maternal and child health centres must implement EHR systems. The electronic pregnancy chart should be developed and deployed. The patient should get access to quality assured information that can make it easier to manage own health and prevent from unnessesary visits to GPs.

Interaction with welfare system The GP is the gatekeeper to the welfare system and will also assist the patient with application for services. The GP's rights to recommend welfare service are linked to the National Insurance Act that provides for the central national insurance and welfare schemes in Norway.

The Norwegian Labour and Welfare Service administer a large proportion of the most important welfare benefits and social security schemes in Norwegian society. For example, these may be unemployment benefits, sickness benefit, rehabilitation allowance, disability pension, and retirement pension on reaching pensionable age.

Status for electronic collaboration: 50% of the GPs were able to communicate electronically with the National Welfare System in 2008. This includes mainly Sick Notes and Medical Certificates. The first electronic Sick Notes were sent in 2004, but still only 25% are sent electronically, and the number has been fairly stable the last three years. The deployment process has been slow, not only due to technical challenges, but also because of organizational obstacles. The benefits for the GPs have not been obvious, and requirements for electronic messaging have also been seen as a means to control the GP's work.

Further work: The GPs request systems for collaboration and not only one way reporting. The patients and users should also be provided with electronic services that make it easier to get knowledge about rights, admitted benefits and status of application processes.

Casual contact patient GP/dentist Many of the patient's with the GP or dentist do not require any referrals to specialized services. These contacts are not handled as acute, and the patient will contact GP's or dentist's practice or to get an appointment scheduled or just to get a prescription or renewed sick note.

Status for electronic collaboration: 23% of the General Practices offered electronic patient services in 2008. An additional 12% had plans for establishing new services in 2009. The number of dentists who have electronic customer services was unknown by the time of writing, but it is likely that less than 10% have such systems. The services that are offered are mainly booking of appointments, renewal of prescriptions, medical certificates and renewal of sick notes. Some GPs also communicate with the patients via a secure e-mail system. As a part of the national ePrescription system, the patients will also be offered services to keep track of their own prescription.

Further work: Patient- and Customer services need to be extended. The patient should be provided with services that can assist in choosing and booking specialized care. The patient should also have easier access to quality assured documentation that can be used as an aid for self care.

5 Conclusion and suggestions for future work

The main findings from the work are summarized in the collaboration map. Solutions that should support shared care and empower the patient are to a large extent lacking. This is contradictory to the Cooperation reform's intention of empowering the patient, and should be focused in further development.

Suggestions for further work are:

- Development of a public health portal
- Development and deployment of telecare solutions to support independent living
- Improvement of electronic collaboration between health workers

5.1 Development of a public health portal

The public health portal should provide the citizens with quality assured documentation that can be used for self care. Information about patient rights, admitted benefits and status of application processes should be made available. Patients should be provided with services for electronic collaboration with the GP, including secure e-mail and booking of appointments. The patient should also be provided with services for choosing and booking of specialized care services.

5.2 Development and deployment of telecare solutions to support independent living

Telecare should be used in order to support the patients in the daily routines and possibly reduce the need for hospitalization.

5.3 Improvement of electronic collaboration between health workers

The national ePrescription system should be made available to all actors that need access. Standardized communication between the maternal and child health stations and other actors like the GPs, maternity wards at the hospital, schools and the national registry of immunizations should be focussed. A national pregnancy chart with core information that needs to be shared by the woman and a group of health workers should be developed. Priority must be given to improve standardized electronic exchange of radiology information. Development and deployment of services for tracing of lab

requisitions and referrals is needed. A core EHR with patient summary information and an overview of the patient's contacts with different actors is also wanted.

More effort should be put into innovative processes that support development of new collaborative systems. All actors that will be involved in collaborative processes must get some kind of benefits [14] from using new systems. If not, deployment is likely to be slow.

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Correspondence

Vigdis Heimly
Norwegian University of Science and Technology
Phone: +47 93435088
http://www.idi.ntnu.no
vigdis.heimly@idi.ntnu.no

Paper 3

The Role of the Practice Consultant in Cross-Organizational Electronic Collaboration in the Health Sector

IEE Computer-Based Medical Systems, CBMS 2010

The Role of the Practice Consultant in Cross Organizational Electronic Collaboration in the Health Sector

Vigdis Heimly
Department of Computer and Information Science, Design and use of Information System Group, Norwegian University of Science and Technology, Trondheim, Norway
Norwegian Centre for Informatics in Health and Social Care, KITH, Trondheim, Norway
vigdis.heimly@idi.ntnu.no, *vigdis.heimly@kith.no*

Abstract

This paper addresses how Practice Consultants can act as boundary spanners [1], [2] in order to improve collaboration and knowledge sharing in the health sector. Practice Consultants are in this paper defined as General Practitioners (GPs) that work in part time positions at hospitals with issues that are related to collaboration between primary care and specialized care. They are often experienced and know the work processes in primary care well. Special attention is paid to how the Practice Consultant can have a role in deployment of systems the support electronic collaboration across organizational boarders. The electronic referral and discharge letter are used as examples of boundary objects that can be influenced by the Practice Consultants work. Their knowledge about the work processes in collaborating organizations can be important for improvement of the quality of care in the patient trajectory.

Keywords: Practice Consultant, Health Care, Referral, Boundary Spanners

1. Introduction

Practice Consultants have traditionally been GPs that work in part time positions at hospitals with issues that are related to collaboration between primary care and specialized care, as described in Kvamme's doctoral thesis [3]. This is also the focus of the Practice Consultant's role in this paper. There are also examples of nurses or physiotherapists [4] that work as Practice Consultants. The Norwegian College of General Practice in Norway has also suggested in their strategy document [5] that a similar system should be established in Community Care.

The Practice Consultants were first introduced in Denmark. According to the report from Muusman [6], as many as 10% of the GPs in Denmark held a position as a Practice Consultant in 2002. From the early start in South Western Norway in 1995, the status in 2009 was that 100 Practice Consultants and 27 hospitals were included in the Norwegian Practice Consultancy System. The Practice Consultancy System is also well established in Sweden.

The European Working Party on Quality in Family Practice (EQuiP) has recommended a strategy [7] for quality improvement across the primary/secondary care interface. They pinpointed that particular attention should be paid to "Bringing GPs and specialists together and developing personal and group relations through education and processes of task sharing is a powerful instrument of change." They also described the Danish Practice Consultancy System as a multi potential method of promoting cooperation between GPs and specialists.

The Practice Consultants do not do clinical work at the hospital. In Norway their mandate is to work with improvement of procedures that are related to collaboration between primary and specialized care. In some contexts, the Practice Consultants can also work with the development of clinical guidelines. Most Practice Consultants do their work related to one medical specialty or ward at the hospital. This could typically be a 20% position and that is held in addition to their fulltime job as GPs. Many hospitals have a group of Practice Consultants and in addition a coordinator who is employed in a 20-50% position.

When the Practice Consultant is present at the hospital he or she will work with tasks like:

- Improving referral quality
- Improving quality of discharge letters
- Reducing waiting time for the patient
- Reducing finishing time for discharge letters

- Building teams around patients with chronic diseases
- Establishing a system for work visits in collaborating organizations
- Improving organization of services in primary care for patients that are ready for transfer from hospital
- Improving guidelines for collaboration
- Contribute to training session in collaboration in acute pre hospital care situations
- Improving electronic collaboration

Work processes where the Practice Consultant can participate would typically include:

- Participate in strategic plan processes at the hospital
- Distribute documentation from general practice to health workers and administrative staff at the hospital and talk with them in order to improve their knowledge about primary care
- Participate in electronic collaboration projects
- Arrange meetings and seminars with GP in then hospitals local area
- Develop guidelines for GPs in collaboration with the specialists
- Make and distribute newsletters to the GPs

An example of the Practice Consultants' work is a survey by a group of Norwegian Practice Consultants [8] that showed that 37 % of the referrals had insufficient information The Practice Consultants in this case have, on basis of the study and in collaboration with the specialists at the hospital, made a checklist for the referral process that can be used by the GPs. A new study will follow to see if the referral practice has improved after the new requirements are effectuated.

Funding has been a challenge since the first trials with Practice Consultants in 1995, and is still an issue in 2010. According to the strategy document from The Norwegian College of General Practice [7], the actors that benefit most from the system are likely to be the hospitals and the patients, but the hospitals have only to a limited degree been willing to pay the costs. The Practice Consultants have different types of agreements with hospitals and Regional Health Authorities. The Practice Consults have a close collaboration with the Norwegian Medical Association.

2. The Patient trajectory

Norway has a public health system. The hospitals are connected to one out of four Regional Health Authorities (RHAs) that are funded by the government. Primary care is the responsibility of local municipalities. Most General Practitioners (GPs) are working in private enterprises, in agreement with their local municipality. The patient's main contact with the health system is the General Practitioner.

All Norwegian citizens are assigned to **one** GP's patient list. The GP is the gatekeeper to specialized care, and with the exception of acute care, all patients who are admitted to the hospital have been referred by their GP. When the patient has finished specialized care treatment, the responsibility for further health services will be transferred back to the GP and primary care.

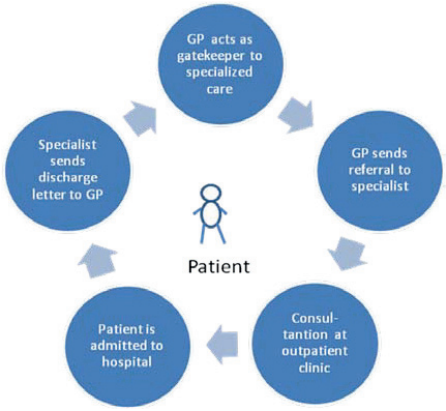

Figure 1: Specialized care trajectory

In most cases this standard trajectory will be followed. If the information is insufficient, the specialist must sometimes contact the GP, patient or laboratories where additional information can be gathered before the patient can be assigned an appointment. Another option is to let the patient go through more tests and procedures in specialized care than actually necessary. Sometimes the GP also has to make a phone call to the hospital in order to get information about new medication that is missing in the discharge letter. Sometimes the discharge letter will also arrive after the patient's first contact with the GP after the hospital stay.

The trend is that treatment of an increasing number of patients is moved from specialized care to primary care. This is also one of the main intentions of an upcoming collaboration reform. More patients are provided with services in community care, closer to

their homes, and at the same time the need for expensive specialized care is hopefully reduced.

This health reform will be connected to economic incentives that will make it more expensive for the municipalities to request specialized care service. The municipalities will have to pay the hospitals according to the number of patients they refer to them, and there will also be a high cost to pay for patients who have finished their hospital stays and wait in hospitals for community care to be organized. This coming health reform will increase the need for collaboration between actors in specialized and primary care. The government has signaled that collaboration between them preferably should be electronic.

3. Support for electronic collaboration

The deployment of electronic messaging in Norway has been much slower than expected, even though all communicating actors have implemented Electronic Health Record (EHR) systems, messaging standards are available, communication interfaces are implemented in the EHR systems, and all actors are connected to the Norwegian Health Net. A series of meetings between the RHAs, The Norwegian Medical Association and KITH in 2007 indicated that the reasons were both technical and organizational [9], but as an increasing number of technical challenges have been solved, more attention has been focused on the interplay between organization and the technical solutions. More and more systems that support electronic collaboration are brought into the market, but new web-based system and core-EHRs do not solve challenges related to knowledge sharing unless these systems support the work processes of the collaborating actors well.

Further development of collaborative systems is needed, but some essential challenges are: How can we design systems that support collaboration across organizational boarders in a way that supports all actors' needs and work well in daily practice? How can we best secure deployment of such systems?

4. Spanning Boundaries

Star and Griesemer [10] have defined boundary objects as "objects which are both plastic enough to adapt to local needs and constraints of the several parties employing them, yet robust enough to maintain a common identity across sites. They are weakly structured in common use, and become strongly structured in individual-site use." The discharge letters and referrals are used by a set of collaborating actors and are to some extent standardized, but in actual use they need to be fitted to the context in question, and can be seen as examples of boundary objects.

The collaboration processes in health care have mainly been supported by paper routines, but electronic systems are now being introduced in many countries [11], [12], [13], [14]. Knowledge sharing is essential to innovation in general [15], [16] and involvement of Practice Consultants in the design and development of new systems may imply a better innovation process for collaborative systems in the health sector. Carlile [17], [18] has used Shannon and Weaver's [19] three levels of communication complexity: syntactic, semantic and pragmatic to describe a framework for managing knowledge across boundaries.

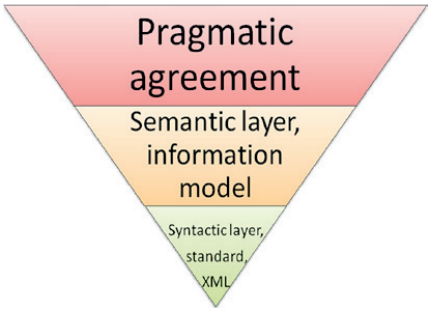

Figure 2: Boundary Framework

The referral and the discharge letters are boundary objects that have a basis in existing standards at the lowest level of Carlile's framework. These standards need to be extended and fitted with local requirements from the hospital and GPs. Requirements will also change over time, and may lead to revisions of the boundary object.

When we see the electronic referral and the discharge letter as cases in relation to Carlile's framework, format standards developed by standardization organizations as CEN or ISO or paper based templates and forms are on the bottom layer. The semantic layer will consist of interpretations of the standards for daily use, where clinicians and other health workers have made agreements on which information they exchange. As an example, an XML-format standard for referrals can be used for exchanging different types of referrals as referrals for rehabilitation, physiotherapy or clinical surgery. At the pragmatic level, different interests among actors have to be sorted out and may lead to changes in daily work processes. It is important to stabilize the system in a way that all actors can see benefits from using the new

services, as exemplified in the report [20] from the introduction of electronic referrals in Denmark.

Boundary spanning primarily concerns the exchange of information [21]. A boundary spanner is defined as "one who attempts to influence external environmental elements and processes". Levina and Vaast [2] and Orlikowski [22] have also studied how organizational competence emerges in practice, and how actors in a new joint field develop interests in spanning boundaries and eventually transforming knowledge. The Practice Consultants can be seen as boundary spanners who can bridge general practice and specialist services in health care and have a special interest in collaboration related to boundary objects.

5. Method

Basis for the paper has been semi structured interviews [23], [24] at two hospitals and with 15 General Practitioners, active participation in a collaboration project with a small hospital where a Practice Consultancy System was established, and a national survey to the hospitals and access to project documentation and reports. Participation in meetings with the hospitals and at national workshops and seminars has also provided valuable information is addition to reading of reports and national strategy documentation.

National survey

A questionnaire was sent to all the 28 health authorities. 23 (82%) of the forms were returned, among them the forms from all the largest hospitals. Most of the actors who filled in the forms were responsible for cooperation departments or were project managers for collaboration projects. The main rationale behind the survey was to find out what the status and plans were regarding electronic collaboration with primary care in general, and the role of the Practice Consultant was specifically seen as important.

The following questions were asked:

- Are any Practice Consultants employed by your RHA?
- If so, describe how many and what their work tasks are.
- What year did you establish the Practice Consultancy System?
- Do you involve the Practice Consultants in electronic collaboration projects with primary care (Electronic referrals as example)?
- If so, describe the Practice Consultant's role in these projects.

Semi structured interviews

The interviews were done in 2009 and 2008 as part of a process to follow the implementation of two different referral projects in Norway. Health workers both at the hospitals and in primary care were asked about their knowledge of the Practice Consultancy System and their opinion of eventual consequences of the Practice Consultants work.

Active participation in a local initiative in Mid-Norway

The author participated in a collaboration project that involved the county administration, a hospital and 11 local municipalities in 1996-1998. The initial goal of the project was to prepare the actors for electronic exchange of electronic discharge letters and referrals. As a part of this process, a Practice Consultant agreement was established. Three GPs and one nurse from primary were employed in part time positions at the hospital. This was done based on the Danish experiences and the first successful attempts in SouthWestern Norway [3].

6. Analysis

17 of the 23 HAs that responded to the survey had employed Practice Consultants. 13 of the HAs noted that Practice Consultants were often used as experts in projects where new ICT-solutions to support shared care are developed. The Practice Consultant's practice was in many cases be used as a pilot site, and most of them are involved in the roll out process.

Most of the Practice Consultants were employed recently, mainly in 2005 and 2006, but some of the hospitals have had Practice Consultants as far back in time as the mid-nineties.

During the interviews at the hospital wards at hospital A, one of the wards had limited experiences with Practice Consultants while the other ward found them useful as catalysts in collaboration processes. The wards complained about limited funding for the position, and difficulties in finding GPs that were willing to work in the position.

Interviews at hospital B also indicated that they found Practice Consultants useful for establishing trust in the collaboration process between the involved actors. This hospital had employed two Practice Consultants, but their workload during the time they were present at the hospital was heavy. As a means to improve collaboration across organizational boarders between the hospital and primary care, they had also recently employed a General Practitioner in a fulltime position in addition to the two 20% positions. The Practice Consultants at hospital B organize regular

meetings where they invite all GPs that belong to the local area of the hospital. In these meetings they discuss issues related to collaboration.
Examples from the meeting agendas are:

- The design of a decision support system for electronic referrals that included guidelines
- Information about ongoing collaboration projects
- Challenges related to introduction of new addressing systems: service based addressing as opposed to people/ward based addressing

The Practice Consultants complained about the fact the number of GPs who were present at these meetings were fairly low, but the feedback from the ones who participated was positive.

The Practice Consultants also distribute a newsletter: "The practice news". This publication was distributed to all the GP practices in the hospital's local area.

Hospital B had designed and implemented a pilot version of a system called "The interactive referral". This is a decision support system that is implemented as a part of the GPs EHR system. A set of clinical guidelines is linked to ICPC diagnoses, and the guidelines for a given diagnose will show up in yellow on the right part of the screen when the GP starts to fill in information in the referral. The Practice Consultants' role in this project has been to restrict the volume of guidelines to a level that felt useful and not too time consuming for the GP to follow, but still could be beneficial enough to improve the quality of the referrals. The number of requirements for each ICPC code was limited to five, and the Practice Consultants also requested that no referrals should be stopped even if all the guidelines were not followed.

Interviews with the 15 GPs showed that the Practice Consultants were trusted by "their own". Many of the GPs had little contact with the Practice Consultants both because the Practice Consultants had limited time to make direct contact, and because the GPs told that they did not have time to go to the common meetings. On the other hand, the fact that the GPs knew that the Practice Consultants were had long experience from daily work in primary care, made them feel confident about that the Practice Consultants could represent GPs in general in a hospital setting. "I think they do a good job on behalf of us, but I do not know them in personal" was an example of how a GP expressed his relation to the Practice Consultants.

Many GPs stated during the interviews that they read the newsletters from the Practice Consultants, but a few also told that they had never read it. The GPs gave examples of input from the newsletter that had proven to be valuable to them. "The information in the newsletter about addressing of electronic messages was very useful to me". The knowledge about the Practice Consultant's work seemed to differ a lot also among GPs that were employed in the same practice.

The experiences from the project in Mid-Norway were also positive. The nurse worked mainly with collaboration issues related to diabetes. The GPs and specialists at the hospital developed new guidelines for referral process. For some patient groups and diagnose codes, it was tried out if the patient could be admitted to surgery without passing though the hospitals outpatient clinic first. This saved time and money for hospital and shifted some work from the specialists to the GPs. In this case, the GPs found this to be a good solution, because they gained new competence. On the other hand, the specialists were reluctant to let the GPs book appointments for surgery without a prior examination from a specialist. The collaboration actors on both sides gained more knowledge about the total patient trajectory and the other actor's needs for knowledge.

One of the main contributions from the project was that the Practice Consultants and the specialists developed recommendations for the structure of a "good referral" and a "good discharge summary". The results from this local project have been used as valuable input to a following national standardization project. They also organized periodical meetings with participants from both general practice and specialized care. They distributed their news bulletin to all GPs in the district. Unfortunately it was not possible to finance the Practice Consultants position after the project ended. The hospital was not willing to pay, and it was not possible to come to an agreement with other actors as the municipal organization in the region.

The collaborating actors in primary care and at the hospital got more knowledge about each others work processes and needs, and new local "standards" and procedures were established across organizational boarders. Still it was not possible to continue the Practice Consultancy Trial after the project finished due to lack of funding. The hospital did not see it as their responsibility to employ the Practice Consultants, the municipality did not provide any funding and at the time there was no national initiative from the Department of Health or the Directorate of Health in order to provide such funding. The Regional Health Authority and the hospitals in the region have later established a similar Practice Consultancy System.

7. Results and recommendations

The national survey shows that an increasing number of hospitals employ Practice Consultants and involve them as boundary spanners in collaboration projects. Interviews with General Practitioners also indicate that they trust that the Practice Consultants do a good job on the behalf of all the GPs in relation to collaboration issues, but they also want them to spend more time in direct contact with general practice. The interviews indicate that Practice Consultants may help to support the deployment process of electronic collaboration systems in the Norwegian Health Sector.

Practice Consultants can probably play an important role as boundary spanners in the process of improving the quality of routines and documentation and in the development of new and innovative systems for handling electronic collaboration across organizational boarders. The interviews, the survey and the case experiences support this conclusion. On the other hand, the interviews indicate that GPs do often not have the time to communicate a lot with the Practice Consultants, but the GPs trust that they can be spokespersons for themselves in processes regarding the design and development of electronic collaboration systems.

The GPs who are willing to work as Practice Consultants are often very experienced and have a lot of knowledge about the work processes in primary care that they can share with specialists at the hospital. They will also be given the possibility to spend some time close to specialists and probably also be more in the position to understand their needs and give feedback to the colleagues in general practice.

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Paper 4

The General Practitioner in the Giant's Web
MIE 2011

The General Practitioner in the Giant's Web

Vigdis Heimly[a,b]
[a] *Norwegian University of Science and Technology*
[b] *Norwegian Centre for Informatics in Health and Social Care*

Abstract. Most General Practitioners (GPs) in Norway use Electronic Health Record (EHR) systems to support their daily work processes. These systems were developed with basis in local needs. Electronic collaboration between the different actors has developed over time. Larger national projects like the ePrescription and the Core EHR are examples of projects that interact with the GPs EHR systems. The requirements from these projects need to be addressed by the vendors of the EHR systems. At the same time the GPs see a need for further development of their EHR systems to make them more suited as tools to support the daily work processes. This paper addresses the how GPs can influence on the design and development of their EHR systems in a situation with a preexisting installed base of systems and increasing requirements from many actors.

Keywords. National deployment, Electronic collaboration, Electronic Health Record Systems, General Practitioners, Practice Consultants, Requirements

Introduction

More than 95% of the GPs currently use EHR systems[1]. These systems were developed in a local setting and deployed on a national basis. The process resembles a bootstrapping process as described by Skorve and Aanestad [2]. The GPs use the EHR systems actively in their clinical work and they do not keep paper records. EHR systems are also in widely use in hospitals and in nursing homes. The development of all these systems has been done with the local actors needs in mind and not the needs of the collaborating actors.

Electronic collaboration is wanted by all actors, but how can we best coordinate at a national level but still provide some room for further development of the EHR systems based on the different user groups needs? One of the main challenges is how to keep the balance between influences from national actors like the regional health authorities and the smaller actors that do not have a strong organization that can represent them at a national level.

Method

The paper is based on experiences from participation in the EHR-monitor study, the initial ELIN-project the GPs' national reference group and a study of available project documentation.

Analysis

In a study from 2009 [3] T. Christensen concludes that "EPR systems in Norwegian primary care that have been developed in accordance with the principles of user-centered design have achieved widespread adoption and highly integrated use. The quality and efficiency of the clinical work has increased in contrast to the situation of their hospital colleagues, who report more modest use and benefits of EPR systems." The study was based on a national, cross-sectional questionnaire survey in Norwegian primary care. They found that the GPs got assistance from their EPR system while conducting most of their clinical tasks, but the GPs also saw the need for improvements of their EHR systems. This was further documented in second study [4]. Examples of missing functionality were decision support that could be adjusted to the individual patient, extended possibilities for electronic collaboration and integration of the GPs EHR with personal health records. The EHR monitor survey [1] has also shown that one of the most evident challenges for the GPs currently is missing functionality of the existing systems.

The ELIN project model

The ELIN projects is an example of a project family where GPs are involved at a national level [5]. A panel of experts creates functional requirements for electronic communication in health care with basis in the existing systems, standards and their local needs. These requirements are implemented in the EHR-systems. The EHR-vendors costs were partly funded by Innovation Norway[1]. The rest of must be covered by licenses that are paid by the users of the EHR systems. This project model has worked out well, but the challenge for the EHR-vendors is that there are many ELIN-projects (health station, community care, general practice, dentistry,..) and the same vendors have obligations in several of the projects.

Support for collaboration across organizational boarders

The growing need for collaboration has become more and more evident over the years. With a large installed base of EHR systems installed by the collaborating actors, it is not an easy task to develop collaboration systems and deploy them in full scale at a national level [6]. This is a complex interplay between the development of standards, technical solutions and the people who use these systems as a part of their daily work processes.

Like many other users, the GPs might to be skeptic to requirements that are established by external actors. If they do not feel an ownership to new systems and modules that they are supposed to use, they can refuse to use them. There must also be some obvious benefits. Even the rumor about the functionality of a system that is defined by another party might make the deployment process difficult. As an example, one of the interviewed GPs in an electronic referral project said: "I have heard about

[1] Innovation Norway promotes nationwide industrial development profitable to both the business economy and Norway's national economy, and helps release the potential of different districts and regions by contributing towards innovation, internationalization and promotion.

the hospital's requirements and that the system is time consuming to use, so I have never tried it."

One way to narrow the gap between clinicians in primary and secondary care can be by establishing a practice consultancy system [7-10]. Practice Consultants are GPs that work in part time positions at hospitals with issues that are related to collaboration between primary care and specialized care. The Practice Consultants can be regarded as boundary spanners [11] who try to engage clinicians both in primary and secondary care to take part in a common Community of Practice [12]. E. Wenger has defined Communities of practice as groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.

Work processes where the Practice Consultant participate would typically include strategic plan processes at the hospital, distribution of documentation from general practice to health workers and administrative staff at the hospital, participation in design and deployment of electronic collaboration projects, arrangement of meetings and seminars with GP in then hospitals local area and development of guidelines for GPs in collaboration with the specialists. A survey related to the introduction of the referral system with decision support showed that GPs tended to trust the practice consultant because they were experienced and regarded as one of their own[6]. Experiences with the Practice Consultants have been good both in Denmark and Norway, although it has been challenges to fund the system [8], [10].

The vendor's challenge

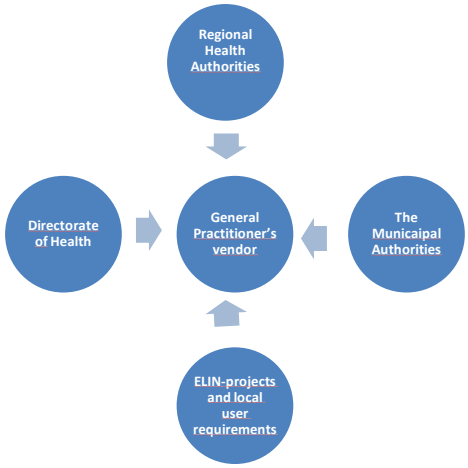

Figure 1: The vendor's challenge

As a wide range of ICT systems have been installed by actors that collaborate with the GPs, an increasing need for extensions and changes to their local systems have emerged. A lot of requirements are put on the vendors of the GPs EHR systems for actors like the Directorate of Health, the regional health authorities, insurance companies, the national insurance scheme etc. The development of national systems like ePrescription, Core EHR, and ELIN-k are funded in national strategies, standards and architectures.

Originally most of the projects started at a local level. The challenge now is how you can balance the external factors and limitations that are set on the development with the local needs. Fewer and fewer of the projects that the GP vendors move into are projects that are only intended for a local market. The vendors need to know that their products can be sold and deployed at a wider scale. The vendors are also short of money for further development of their systems because scarce resources are being kept by other actors. There is a contradiction between the local needs and the potential for moving into a broader market. The users groups will also vary from project to project and there is no link between them.

During the recent years the EHR vendors have been obliged to satisfy national requirements. The vendors have user forums and user groups, pilot users claim that the vendors cannot afford to prioritize the local needs to the same extent as before, because they have to pay more attention to needs from the collaborating actors and the authorities. The GPs do not have a national body where that can represent them in a national setting. They are linked to the Municipal Authority (KS) and the Norwegian Medical Association, but these organizations have a wide focus that the GPs consider to be too wide.

The GPs' national reference group

A group of ICT experienced GPs took the initiative to establish a national reference group in 2010. The Norwegian Medical Association has a subgroup named the Norwegian Association for General Practice, where the reference group is connected. Their focus is on further development of electronic health record systems in General Practice. Most of the GPs in the group have broad experience from being pilot users in various ICT projects, practice consultants or users representatives in the vendor's users groups. The GPs also have a very active online forum where they discuss ICT related issues vividly. The reference group also uses this forum to get active feedback on the work that they do.

The reference group has so far come up with a list of more than 30 action points where they want improvements of their EHR systems. Some of these action points are general and wide (decision support) while other are more concrete and limited (suggestions for improvements of the interface of a communication module). Some of the action points only have implications for the systems in general practice, while others are related to the collaboration with external actors. The GPs have also experienced that promising pilots have been stopped, because there are not available resources for the deployment process and want more focus on deployment processes. The reference group first of all wants more money and programming resources to the vendors, in order to ensure that they can continue to improve the EHR systems based on the GPs needs. The GPs are willing to pay parts of this bill by increased licenses, but they also try to get national funding from the Directorate of Health and Innovation Norway. These actors have been positive in terms of supporting the initiative that seems promising. So far this process is at an early stage and it remains to see how this Reference group will find its role among all the other national actors. A possible model for further development of the EHR systems in general practice is illustrated in the figure 2.

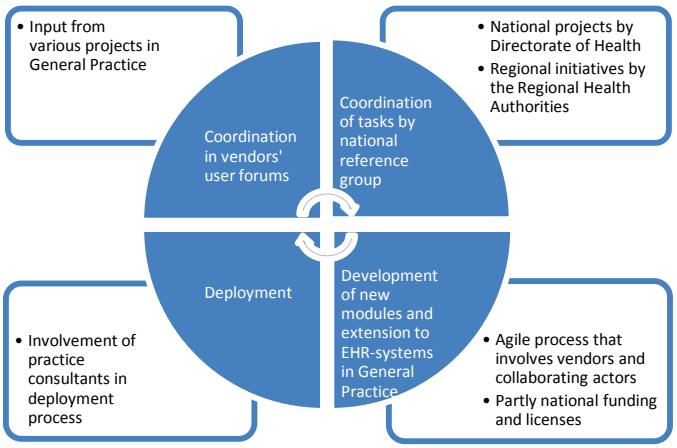

Figure 2: Development model for EHR in General Practice

Recommendations for development:

- Requirements from local projects and users are discussed and prioritized in user forums
- The GPs national reference group coordinates and prioritizes tasks with national project, and works for funding.
- Vendors develop new functionality in collaboration with GPs, Practice Consultants and other collaborating actors.
- Practice Consultants partake actively in the deployment of new functionality.

Conclusion

External actors put an increasing pressure on the EHR system vendors in terms of requirements for new functionality. The GPs own possibilities for influence on the EHR system development has decreased simultaneously. The development of new functionality should still have a basis in the local needs, but coordination at a national level is also needed. A model with a national reference group that is initiated by the GPs is tried out. Experiences from Danish and Norwegian collaborations projects also show that active involvement of Practice Consultants in design and deployment of collaboration functionality can be recommended.

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Paper 5

Clinical guidelines as decision support in the referral process in primary care, IEEE International Conference on Information Reuse and Integration

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Clinical guidelines as decision support for referrals from primary care

Vigdis Heimly [1,2]
Øystein Nytrø [1]

1. Department of Computer and Information Science, Design and use of Information System Group, Norwegian University of Science and Technology, Trondheim, Norway
2. Norwegian Centre for Informatics in Health and Social Care, KITH, Trondheim, Norway
vigdis.heimly@idi.ntnu.no

Abstract

This work describes the use of clinical guidelines in public health care for decision support in a primary care record system. The clinical guidelines were used for decision support in primary care in order to improve the quality of electronic referrals to a hospital. Guidelines were developed by the specialists at the hospital, but the design and the development of the system was done in collaboration with general practitioners working in primary care. This paper sums up the findings from a study six months after the introduction of the decision support system, and is based on interviews with users in primary care. The work processes differed between the practices; General practitioners who wrote the referrals after the patient had left the office did not find the system as useful as the ones who wrote them when the patient was present. The general practitioners were reluctant to use guidelines that resulted in an additional workload in terms of providing the hospital with more information than before, but found the system useful as a support for assuring that they made the right clinical decisions. The guidelines were also seen as useful as a support for refusing to refer the patient to specialized care.

Keywords: *Decision support, electronic referral, electronic collaboration, quality, electronic health records*

1. Introduction

Norway has a public health system, but private specialists and a few private hospitals also have a limited market share. Each hospital is administered by one out of four Regional Health Authorities (RHAs) that are funded by the government. Primary care is the responsibility of the local municipalities. Most General Practitioners (GPs) are working in private enterprises, in agreement with their local municipality. The patient's main contact with the health system is the GP who acts like a gatekeeper for secondary care. Each citizen is assigned to one GP's patient list. When the GP decides that a patient needs specialized care, a referral is sent from the GP to a specialist. The patient is free to choose which hospital or specialist he or she wants to be referred to.

The GPs use their electronic health record system as a basis for the referral process. More than 98% of the GPs have electronic health record (EHR) systems and they have been in common use for more than 10 years. Most hospitals and private specialist also have EHR systems.

Hospitals and GPs are connected to the Norwegian Health Net that is a secure high speed network for use in the health and social sector. Modules for producing and sending electronic referrals are integrated with the GP's EHR systems, but the number of electronic referrals sent is still low in many parts of the country. This has been due to both technical and organizational challenges [1-2], but the usage is increasing slowly.

The Norwegian hospitals have a constant pressure from the government on the need for reducing costs per hospital stay and at the same time increasing the number of patients that they treat. Improved referral quality is one of the factors that hospitals focus on in this context. This could imply that more tests could be performed by the GP before the patient is referred to the hospital, or that more information about the patient's function level is provided in order to make it easier to plan how long the patient has to stay or what kind of assistance is needed. One possible way of improving referral quality is through introducing clinical guidelines as decision support in the referral module in the GP's EHR system. This has been trialled on a limited scale in projects in Western Norway and Northern Norway. There are no publications from the project in Western Norway yet. The project in Northern Norway [3] has a focus on reducing the number of contacts with the hospital before surgery, and is called the "One Stop Project". This project

objective is to aid the GP in the process of filling out a referral template. So far the GPs have been reluctant to participate in the project.

Paper based guidelines for use in the referral process have been in available in Norwegian health care for many years. These guidelines have been developed in collaboration between representatives from primary care and the hospitals. The representatives from primary care have often been Practice Consultants [4-6]. Practice consultants are GPs who work in part time positions at the hospital with issues that are related to collaboration across organizational borders. The main drawback with the paper based system has been that the guidelines are not easily accessible in the referral process, and that they are not updated on a regular basis. Studies has shown that it is essential to integrate decision support with the record system in order to achieve effects [7].

Internationally there are several examples of projects where clinical decision support (CDS) has been integrated with electronic referrals. Examples are the Early Referrals Application (ERA) that was developed in the UK [8], the Choose and Book system in the UK [9-10] and Zorg Domain [11] in the Netherlands. Experiences from these projects indicate that it is difficult to get a good tradeoff between how strong the requirements should be, because GPs are reluctant to use systems that implies a heavier workload on them or might result in major changes in work processes. A recent US study on CDS integrated in primary care EHRs shows that stronger recommendations and stricter formats gives less user satisfaction and corresponding effects [12].

2. The hospital case

Our study is from a medium size Norwegian hospital, HOSPA. In order to try to improve referral quality, a decision support project was introduced on a limited scale. Six GP-practices and two hospital wards (gastroenterology and urology) were chosen for the project. As an average, 6-7 GPs work in each general practice.

The GP practices had already introduced electronic referrals two years before the project started, and some GPs were sending electronic referrals to the hospital, but on a limited scale.

The clinical guidelines were developed by the specialists at the hospital. The guidelines were based on international guidelines and recommendations, but they were also to some extent adjusted to local needs. Five sets of guidelines were developed for urology. These were:

Men's LUTS (Lower urinary tract symptoms). The symptoms occur frequently. It is essential to clarify the reason for the symptoms, and whether it is a physical hindering in the prostate or not [13]. The the guidelines requested to clarify:

Is the patient a candidate for surgery?

Are there any indications of prostate cancer?

Is kidney failure likely?

Phimosis in young boys. Phimoses is a condition where, in men, the male foreskin cannot be fully retracted from the head of the penis. This condition is common in young boys, but surgery might sometimes be needed. This procedure is also a source of dilemma and controversy and might also lead to complications [14]. Guidelines have been developed in order to help the GPs to decide which cases that needs to be referred to the hospital.

PSA. Prostate-specific antigen (PSA) is a protein that is present in small quantities in the blood plasma of men with healthy prostates, but is often elevated in the presence of prostate cancer and in other prostate disorders. The guidelines assist in the decision of which patients that should be referred to specialized care and how the test results should be interpreted [15].

Hematuria. The guidelines describe the different forms of hematuria (blood in urine) and provide recommendations for which groups that need to be referred to the different wards at the hospital depending on age and zone of risk [16-18].

Kidney stone. Kidney stones occur frequently and most cases do not require any interventions, while other cases may require surgical intervention. The guidelines assist in sorting out which cases need to be referred to specialized care for elective or acute treatment [19].

Guidelines for gastroendotology were developed in line with international guidelines from [20-27]. The themes covered were chronic diarrhea, gastro-esophageal reflux disease, abdominal pain, anemia/blood in feces, inflammatory bowel disease and colorectal cancer.

An example of a short guideline for kidney stone is:

Patient with detected kidney stone in kidney or ureter can primarily be referred to the hospitals urology ward. Absence or presence of complications (pain or infection) influences in the urgency level.
Referral to acute care if:
Detected kidney stone or highly suspected kidney stone AND intense pain that cannot be treated in ambulatory care or signs of infection
Referral to outpatient clinic if:
Detected kidney stone and no signs of infection. Symptoms can be handled in ambulatory care.
CT scan or X-ray must follow the referral.
Referral can also include:
Urine-stix: (Hb, Leuk, Nitritt and Ph)

Lab: (CRP, White, Kreatinin)

The guidelines were maintained in a tool called the EHR interactor. The EHR interactor system was linked to the specialist's EHR system. Once a new guideline was updated at the hospital, it would also immediately be made available in the GP's EHR system. The guidelines were linked to ICPC2 (International Classification of Primary Care) codes. This coding system is used by all Norwegian GPs. Some guidelines might apply for a whole group of codes, and the guideline would then be shown to the GPs for all relevant codes.

The electronic referral was integrated with the GP's EHR system. When the GP decided to refer a patient to specialized care, information from the patients EHR would automatically be transferred to the referral form. This included information about current medication, family history and present status. Once the relevant diagnosis code was filled in, a window with relevant guidelines would show up on the right side of the screen, if such guidelines were available. There was no strict control on whether the GP followed the guidelines or not, they were only a support for the daily work process. The referral was then sent as an electronic message to the hospital. There was technically no difference in how the referral message was sent whether the decision support has been used or not.

The guidelines seen from the GPs perspective

The specialists originally wanted the guidelines to be more extensive than they are today, but the user representatives from primary care pinpointed that a maximum number of five bullet points can be expected to be read in every guideline. The GPs did also not want any automatic input controls that could restrict the GP's work processes.

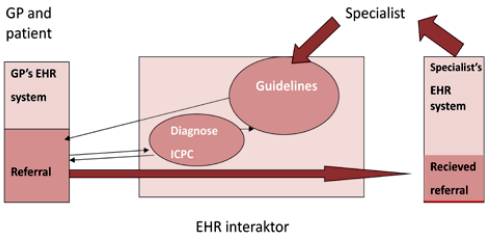

Figure 3: Maintenance and use of clinical guidelines

3. Method

The work has been based on:

Participation in meetings at HOSPA. This includes a meeting in the steering committee, a project group meeting and three meetings with project members at HOSPA.

Group meetings with the GPs at their local practices. All the GPs, nurses and secretaries who were present in the office participated together with project group members from HOSPA. The project staff from HOSPA included project manager, technical staff and preferably also one of the practice consultants or GPs who had been active in the project. The meetings started with a brief presentation from HOSPA, but apart from that the GPs talked about the experiences they had with the system so far and ask questions about issues they were unsure of, or things they wanted to be improved. One meeting was held at each of the 6 general practice locations that participated in the project.

Semi-structured interviews with:

- Administrative staff that is responsible for handling of the referrals when they first reached the hospital.
- Specialists who had been responsible for the development of the clinical guidelines.
- GPs who had been participating in the project as user representatives or practice consultants.
- GPs who have experiences with use of the decision support system in their daily work

These interviews were performed independently from the meetings. There are usually 5-7 GPs who are employed at each location, but they are seldom present at time same time. All the GPs who were present at the time of the visit were interviewed, regardless of what their role in the project had been. A total number of 20 GPs were interviewed. In one location, only one GP was interviewed because they had just recently started and had little experience with the project so far. The other GPs had used the system for 6-10 months at the time of the interviews. Four GPs were interviewed at four locations and three GPs were interviewed at last location. The interviews were semi structured [28]. The GPs were free to provide all the input that they wanted about experiences with the project, but some questions were asked to all GPs. Examples of such questions related to the use of the guidelines were:

- What do you think of the level of detail requested in the recommendations in the guidelines?
- When do you use the guidelines, and do you see any benefits from using them?
- Which improvements do you think should be made to the decision support system?

The GPs are often very busy, and the interviews were done between patient visits or when the GP could squeeze in a little bit of time for an interview during the day. This would often be during lunchtime. The interviews were analyzed in nVivo.

This work has not evaluated whether the decision support has had any effect on the quality of the referrals to the hospital. A separate evaluation of the quality has been done by the clinicians, but the results are not yet published. Preliminary results indicate that it is difficult to see any changes in the quality at this stage of the project.

4. Results

The GPs were positive to the use of electronic referrals in general and preferred to use them if they had an option to send electronically instead of paper referrals.

The only GP who did not send electronic referrals to HOSPA had not tested the system, but only heard from someone else that it was "difficult to use". Even if the decision support was only available for a few diagnosis codes, the GPs also sent referrals that were related to all kinds of diagnoses. With a few exceptions, all of the GPs had used the decision support system.

The GPs said that they felt more confident about which patients they should refer to specialized care and which cases they were expected to handle at a local level when they used the decision support function. The decision support was also felt useful is communication with the patient in order to document why the case was not referred to specialized care. Many of the GPs referred to phimosis in young men as a good example where they also used the guidelinges in communication with the partens.

Most GPs meant that the level of the decision support was not too detailed: "We appreciate that the specialists have accepted that they cannot ask for information that is nice to have. If we shall use the guidelines, they have to be short and to the point."

The GPs could also decide by themselves if they wanted to adhere to the guidelines or not. They said this was a great advantage, because they did not have to stop if requested information was missing.

Some GPs also found it useful to have guidelines on which test that should be analyzed prior to referral: "The guidelines are very useful as a checklist. Then I know that I have not missed out on something that is important for the specialists to know".

On the other hand there were also GPs who said that the number of tests/procedures that were requested exceeded what should be included in the GPs daily work tasks. "I have spent a whole day on following up a referral by phone because the hospital claimed that tests were missing. They did not accept my request for urography because I did not have the right form in my EHR system and wrote a letter instead".

Some GPs claimed that the hospital wanted to move too much of the work load from specialized to primary care and that the suggested guidelines were still too detailed.: "I think some of these procedures are very tough for the patient and you really need a very good indication to do them. I think it should be the specialist's responsibility to request them."

On the other hand, there were GPs who requested why the hospital could not let them do direct booking of "simple" surgical procedures without the need of an appointment at the hospitals outpatient clinic. It was referred to the fact that many private specialists would admit patient for knee procedures without an introductory contact, and that the patient could be saved for a long waiting time and sick leave from work.

The GP's representatives in the project team had pointed of that the it was important that the system should not require more time to be used for the referral process than before the system was introduced. This is in line with findings in a study from the UK [29] where the GPs were reluctant to use the Choose and Book system because of additional workload. The GPs were mostly positive to the way that the hospital had handled the relation to them during the design, development and pilot phase. They had been involved through their representatives Even if the GPs had been in direct contact with the practice consultants, they signalled that they trusted them as their representatives.

Many of the interviewed GPs had a good relation to HOSPA because they had worked there themselves or because they had a long term relationship with HOSPA and had a trust in that they offered high quality services. In theory patients in Norway has a free choice of hospital, but in practice both GPs and patient select the local hospital as their first choice unless the waiting lists are exceptionally long. This is line with experiences that Green et. Al. found when they asked patient about their use of the Choose and Book system in England [29]. This would often also save the GPs from spending extra time in contact with a hospital where they are not familiar with the internal organization, and the referral process can also be more time consuming. As an example one of the GPs told of a patient who had a grandmother who lived close to another hospital, and that she (the GP) had to send the referral to this hospital first, before the patient finally wanted the referral to be redirected to the local hospital.

On the other hand HOSPA had a reputation for long waiting lists for patients that were referred to the gastro

department. One of the main reasons why HOSPA had chosen gastro as one of their pilot wards was that they wanted to provide the GPs with better service from this department and hopefully attract more patients that were handled by private specialist today. During the pilot period this strategy did not seem to work. The interviewed GPs still referred many of the cases that did not require acute surgery at the hospital to private specialists. The interviewed GP told that this was mainly due to the long waiting time for the patient. They did not have any objections to the quality of the services from the hospital, but improved possibilities for electronic collaboration and the access to decision support did not make them change service provider as long as the waiting times still were longer.

The decision support did not fit equally well with all of the GP's work processes. Some of the GPs write the referral after the patient has left the office, and the decision support would then be available too late in the work process, because you get access to it at the time when you enter the referral module and write the ICPC-code.

The current version of the system offered a very limited number of guidelines. The GPs wanted to have access to guidelines for more specialties. The existing general guidelines should also be connected to more than one ICPC code.

5. Recommendations

The GPs were positive to decision support when they felt that it fit with their need and local work processes. The collaboration between specialists at the hospital, GP and practice consultants in the project seemed to have contributed to the GPs' positive attitude. The GPs were satisfied with the way that they had been included in the project and that their input had influenced on the design. It is specially recommended to include user who have a similar role like the practice consultants in projects that are related to collaboration across organization borders.

The comments from the GPs also indicated that the GPs are not a homogeneous group. The work processes differ from GP to GP and more work with the product is needed in order to better satisfy the GPs as a mixed group. Even within a practice office, some GPs wrote the referrals while the patient was present in the office while others did postpone this until the end of the day or a time when the work did not interfere with patient consultations. This means that the GPs also need to have access to the guidelines earlier in the work process than at the time when they actually write the referral.

There were also differences in whether the GP primarily had focus on the patient needs and accepted to do more work locally, or if the GP was reluctant to taking on an additional work load in order to improve the quality of the referrals. A good decision support system seemed to be a useful aid in the referral process, but if the result in the end is longer consultations and fewer patients treated, most GPs would probably object to using the system. If the decision support could be kept at a level that leads to a "win win" situation for both GPs and specialists, the system is likely to be used and maintained by all parties.

The number of guidelines in the system was too limited. The maintenance of clinical guidelines is time consuming and requires participation from the actors who are supposed to use them. HOSPA is a medium size Norwegian hospital, and it is not likely that the costs regarding maintenance and development of the guidelines can be justified by the benefits. It should be considered to cooperate with other actors at a regional or national level in order to establish a basis of specialty specific guidelines that can be used by all hospitals and then extend this basis with necessary additions at a local level.

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Paper 6

Consent-based access to core EHR information, Collaborative approaches in Norway*, Methods of Information in Medicine 2009*

Consent-based Access to Core EHR Information

Collaborative Approaches in Norway

V. Heimly[1,2]; K. E. Berntsen[1]
[1]Norwegian University of Science and Technology – Department of Computer and Information Science (NTNU – IDI), Trondheim, Norway
[2]Norwegian Centre for Informatics in Health and Social Care (KITH), Trondheim, Norway

Keywords
Consent, core EHR, EHR, patient summary, medication, information systems, socio-technical approaches, information infrastructure

Summary
Objective: Lack of access to updated drug information is a challenge for healthcare providers in Norway. Drug charts are updated in separate EHR systems but exchange of drug information between them is lacking. In order to provide ready access to updated medication information, a project for consent-based access to a core EHR has been established.
Methods: End users have developed requirements for additions to the medication modules in the EHR systems in cooperation with vendors, researchers and standardization workers. The modules are then implemented by the vendors, tested in the usability lab, and finally tested by the national testing and approval service before implementation. An ethnographic study, with focus on future users and their interaction with other actors regarding medicines and medication, has included semi-/unstructured interviews with the involved organizational units.
Results: The core EHR uses the EHR kept by the patient's regular GP as the main source of information. A server-based solution has been chosen in order to keep the core EHR accessible outside the GP's regular work hours. The core EHR is being tested, and the EHR-vendors are implementing additions to their systems in order to facilitate communication with the core EHR. All major EHR-system vendors in Norway participate in the project.
Conclusions: The core EHR provides a generic basis that may be used as a pilot for a national patient summary. Examples of a wider use of the core EHR can be: shared individual plans to support continuity of care, summary of the patient's contacts with health providers in different organizations, and core EHR information such as important diagnoses, allergies and contact information. Extensive electronic cooperation and communication requires that all partners adjust their documentation practices to fit with other actors' needs. The implementation effects on future work practices will be followed by researchers.

Correspondence to:
Vigdis Heimly
Norwegian University of Science and Technology
Department of Computer and Information Science (NTNU – IDI)
Sem Sælands vei 7–9
7491 Trondheim
Norway
E-mail: vigdis.heimly@kith.no

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Introduction

Professor Anders Grimsmo at the Norwegian EHR Research Centre has estimated that medication-related errors cause 190 deaths/year in Norway (population 4.5 M) and that 160,000 unintended incidents occur outside hospitals every year. The estimates are based on results from [1]. A study in Trondheim municipality revealed that in 50–90% of the cases where the municipality administrates a patient's medication, there were discrepancies in the information about medication between the home nursing care and the patient's GP [2]. A study has indicated that 35% of such errors could be prevented [3]. It is assumed that a considerable number of these medication-related errors are due to faulty or inaccessible drug information.

An increasing number of elderly people live at home and municipal authorities seek to provide them with integrated care. This implies securing both safety, medical treatment, pastimes, bolstering of independence and self-respect, as well as sustenance and cleanliness. Medication, which involves both ordination information, distribution of medication, evaluation and sampling as well as documentation and its coordinative communication, is a significant but yet only a part of employees' daily concerns. The work practices of home care nurses, and those of the other involved parties, are characterized by a hectic pace and the arrival of eventualities that fragment the flow of orderly processes [4].

In terms of keeping their drug charts updated, the clients who live mainly in their own homes pose a large challenge due to the need for collaboration between many actors. While securing consistent information on a patient's medication is in the interest of all parties involved, the sheer number of actors also complicates the issue. As well as involving a variety of units and employees within the municipality's own organization, other actors include private doctors, the county hospital in case of emergencies or planned treatments, pharmacies, the multidose supplier, social security's medication refunding systems, various rehabilitation and specialist facilities, nurses for hire and alarm-call services. Not to discount the efforts of family and friends who

also figure as part of the picture. This plethora of private vs. public and semi-public organizations ensures that electronically based communication and collaboration is a complex challenge and currently virtually non-existent due to both lacking technological solutions as well as suitable regimes of collaboration that may satisfy juridical and privacy concerns. Initiatives to achieve more electronically based communication now appear near fruition, after some 20 years of diverse efforts, in the shape of a core EHR.

Objectives

In order to reduce the number of drug-related unintended incidents, Trondheim municipality initiated a drug chart project based on a core EHR. The project focuses on a group of mostly elderly people (age 80+) living at home but with an extensive need for healthcare services.

The project was launched as a joint initiative between the municipality of Trondheim, the Norwegian Centre for Informatics in Health and Social Care (KITH), the Norwegian EHR Research Centre (NSEP), and the regional ICT unit of the Regional Health Authority of Mid-Norway (HEMIT). KITH has a national responsibility for standardization of electronic cooperation in the health and social sector in Norway. The project is linked to the Norwegian government's national strategy for e-Health, Teamwork 2007 [5].

The collaboration between diverse types of end users, various providers, standardizing and funding bodies along with actors who hold supplementing competence in areas like medicine, ICT and research related to socio-technical studies on information infrastructures has been assumed to provide an arena for creative processes whose results may be reused by the more than 400 other municipalities in Norway. In addition to reuse of results at a national level, the project is also linked to international standardization and research with basis in the European Commission's eHealth action plan [6]. Actors from KITH and NSEP have ongoing collaboration with European research and standardization initiatives related to patient summary, allowing for mutual exchange of information in a wider context. Development of national standards has been limited to areas where international standards did not cover the project's requirements.

Although the initial objective was to reduce the number of drug-related incidents at a local level, work so far, including the study on work practices, has indicated that there is a need for a core-EHR solution which could be used for more purposes than drug information alone. A wider objective is to provide a basis for a more generic Norwegian core EHR.

Methods

"Action research aims to contribute both to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint *collaboration within a mutually acceptable ethical framework*" ([7], p 7). The described strategy for establishing both technology and suitable collaboration, for securing updated information for the municipality's clients, may be seen as an example of action research. While the government's and other actors' motivation might espousedly be one of pragmatics based on lessons learned, the resulting project and its wider interaction fits the theoretical definition of action research. Additionally, the wide participation aiming to bridge and negotiate the differences and requirements of a wide range of diverse actors represents a socio-technical approach to systems building characteristic of insight from research on information infrastructures and their establishment [8].

The main author has followed the project as a case from the initiation. The project has used a development method which has been applied with success by several cooperative projects within the health sector in Norway in recent years. End users develop requirements for additions to the EHR systems that can facilitate the collection of the information necessary for work practices. This is done in cooperation with developing providers and vendors, researchers and standardization workers. New standards, or extensions to existing ones, are developed by KITH based on the users input. Vendors subsequently develop new EHR modules based on the requirement specifications. The modules are then tested in the usability lab at NSEP, and the vendors' implementation of the communication standards are tested by the national testing and approval service at KITH. The vendors are refunded only 30–50% of their development costs via public funding. The remaining development costs are meant to be covered by customer licenses when the project in spread to new users.

The cooperation with NSEP and the University of Technology and Science in Trondheim (NTNU) has also provided opportunity for the second author to follow the project as a participant of an ethnographically inspired study to gain insights into the future users' daily work practices, routines and challenges. In particular, focus was on their interaction with others in regard to medicines and medication. The study included semi-/unstructured interviews with nine organizational units collaborating on medication of the client, several of which will participate directly in the pilot project. The other units will be implicated indirectly.

Results

The Core EHR Drug Chart

The core EHR uses the EHR kept by the patient's regular GP as the main source of information. All Norwegian healthcare providers are obliged to forward any relevant health information to the patient's regular GP unless the patient explicitly refuses. Drug information is automatically copied from the GP's EHR to the core EHR on a separate server that handles the requests. A server-based solution has been chosen in order keep the core EHR accessible outside the GP's regular work hours.

The core EHR will be updated automatically when pharmacists, hospitals and other healthcare providers send information to the GP. Information about medication that is changed or new will be transferred from the hospital to the GP when the patient leaves the hospital. Information about cures and medication used only at the hospital will not be considered part of the core EHR, and will not be sent. The patient's GP is responsible for the core EHR and will check all information received from other healthcare providers in order to detect any medication inconsistencies before it is accepted as part of the core EHR.

Actors will receive updated drug-information based on requests sent to the core EHR system. Each request is automatically checked against the set of distribution rules and if the request is covered by one of these rules, a message containing the requested information is automatically returned. Medication messages that have not yet been handled by the GP will also be visible, but will be clearly marked as unread.

The patient and his/her GP jointly decide the distribution rules to be followed:

- distribution rules are partly based upon ENV13606-3;
- who may receive healthcare information;
- explicitly named healthcare professionals to be included or excluded;
- healthcare professionals having a specific role;
- why they need to receive healthcare information.
- A set of standardized request options is used to specify why the requesters need the information.
- The patient's consent is either given for a specified period of time or for a specific period of care.

When the GP registers the patient's consent, the patient will also be provided with a document that shows the actors that are given access to his/her drug chart. The patients may at any time change or withdraw their consent, or change the distribution rules.

To comply with Norwegian legislation, the core EHR is updated by messaging. Standardized messages will be implemented by the vendors. Access to the core EHR can also be provided by web-services.

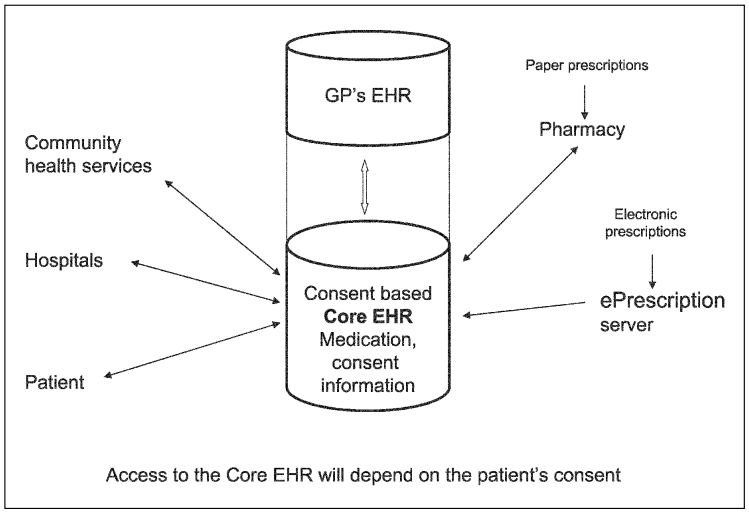

Fig. 1 Core EHR[a]

Discussion

All EHR-Systems Need to Communicate with the Core EHR

To achieve an up-to-date drug chart, it is also necessary to involve all the EHR-system vendors related to all the actors that contribute input to the chart. This means that vendors of all the communicating EHR systems had to be included in the development project, ranging from hospitals to GPs and home care nursing facilities. The inclusion of the pharmacies was also attempted, but although positive their participation has been delayed.

All the hospitals in Regional Health Authority (RHA) Mid-Norway are using the same EHR system from Siemens. The EHR systems in the region are all operated from the same location, but the hospitals' databases are kept separate due to Norwegian legislation. Doosselaere et. al. [9] give an overview of issues related to legal and regulatory barriers or gaps that may exist between current EU-regulations and the need for sharing information in eHealth applications. Norway also has challenges with legislation within its own borders. Although it would be technically possible to share EHR information between the hospitals, this cannot be done without the patient's consent.

The municipality of Trondheim uses an EHR system in community care from the vendor TietoEnator. This system is in use at both nursing homes and homecare by both administrative workers and healthcare providers.

The GPs in Trondheim have been using EHR systems for more than a decade. They do not keep paper records any more, and rely solely on the electronic record. The GPs use their EHR system actively while the patient is in the office. Thus their systems need to be easy to use, and new functionality must only be added in a way that does not force changes in work routines without also providing identifiable benefits. There are currently EHR systems from two vendors, Profdoc and Hove Medical in use by the municipality's GPs.

The project involves many actors and also covers the development of new standards. This adds to the complexity of the project, but the project would on the other hand also not be possible to sustain as an isolated pilot. Ideally one would like to develop a small standalone pilot as a starting point, but drug charts are already in use as a module in all the vendors' EHR systems. The issue is not lack of drug charts, but rather the lack of coordination between them. The existing drug charts may be regarded as pilots that demonstrate a need for better integration by involving all the implicated actors from the set out.

From Local Project in Trondheim to SUMO

Stavanger and Tromsø municipalities also initiated local drug chart projects at the same time as Trondheim. Tighter cooperation between the projects was considered to be beneficial in the long run, although this

[a] Based on a model by Torbjørn Nystadnes, Norwegian Centre for Informatics in Health and Social Care (KITH).

would also to some extent cause delays. Development of common standards and implementation of the same standards for all EHR vendors would be highly advisable, both from the vendors', users' and the authorities' perspectives. The project in Trondheim municipality only counted for one third of the EHR-vendors in Norway, but with a joint project between Stavanger, Tromsø and Trondheim all major vendors would be covered. The three projects thus decided on cooperation, and the projects in Trondheim and Tromsø are now using the same core-EHR system. All three projects plan to use the same set of message standards. To comply with Norwegian legislation, the core EHR is updated by messaging. Access to the core EHR can alternatively also be provided by web-services.

An application for funding the EHR-system vendors' development of client modules for interaction with the core EHR was sent to Innovation Norway, and was approved late 2006. The funding was limited up to 50% of the vendors' own cost estimates. The requirements from Innovation Norway were that the implementations should be based on standards and use of the Norwegian Cooperation Architecture [10]. KITH has developed the national cooperation architecture in cooperation with the RHAs, the Directorate of Health and the Norwegian Medical Association. Basic requirements for this architecture are:

- All messaging traffic should use the national broadband infrastructure, The Norwegian Health Net.
- Only standardized messages should be used.
- The vendor's message implementations should be approved by the Norwegian Testing and Approval Service at KITH.
- ebXML framework should be used.
- Application receipts should be sent for all messages.

A project to coordinate the vendors' work, called SUMO, was established in early 2007. The SUMO project has been running a number of workshops with vendors and users throughout 2007. Messaging standards for administration of the core EHR, and exchange of EHR information, have been developed by KITH based upon requirements from users and vendors in the SUMO project. The new messaging standard for communication between the EHR systems is based on reusable components [11], and will probably prove to be a useful basis for development of future communication standards in Norway. Requirement specifications for the client modules in the vendors' EHR systems have also been developed. The vendors are in September 2008 at a stage where they are implementing the standards and the client-modules in the EHR systems. The project is due to finish in 2009, and the first pilots will be up and running during 2008. The core EHR is already developed, and is scheduled to be tested by Trondheim and Tromsø municipalities.

Implications of the Development Strategy

The project works closely together with the national ePrescription project and other national projects initiated by KS[b], the Norwegian Nursing Association and the Norwegian Medical Association. These projects are strategic and also linked to [5].

It is crucial for the vendors that larger national projects are coordinated and that the same set of standards can be shared and reused. The Norwegian vendors do not want to develop non-standard solutions. The vendors want new modules as part of a standard package, and even if the development of a new module was fully compensated, the maintenance cost would still be high for both vendor and customer if the module did not comply with the installed base.

From the start of the project in Trondheim municipality, the initial project's expected completion date has been delayed with at least a year. This is mainly due to the need for coordination with other projects and national initiatives. The fact that the vendors have a limited number of software releases per year, including that release dates do not match across vendors, has also been a challenge. This has caused individual delays of up to five or six months.

[b] The Norwegian Association of Local and Regional Authorities (KS) is a national organization for municipalities, counties and public enterprises under municipal or county ownership.

The above illustrates an apparent need for the existence and cultivation of large networks of action which coincides with research insights from the development efforts on health information systems through action research in South Africa [12].

Context and Future Work Practices

Other issues to be evaluated are the overall effects of the new systems for the work practices of the various healthcare providers. The core EHR effectively provides a gateway for secure electronic communication on client medication between diverse parties and technological platforms. While this ensures a common location of documentation, it remains to be seen how the various actors will need to adjust their documentation practices in terms of timing their activities as well as tailoring their information in order to ensure usability for the various end users. The standard ensures structured information, but end users, with the help of their own EHR, will still need to 'translate' the information to a form suitable for their own uses. For instance, what the doctor ordinates may be substituted by the pharmacy with the synonym-drug they have available, which may result in two pills with another name instead of the original one. The home care nurse may need to alter the timing of dispensing, compared to the doctor's ordination, in order to accommodate their own or a client's timetable. Lessons from the research within CSCW (Computer Supported Cooperative Work) indicates that work processes will need to be continually revised when new technology provides new functionality in interactive contexts. Collaborators will need to develop new patterns of interaction through the new media [13]. The implementation effects for future work practices will be followed by researchers.

Conclusions

The work so far, including the ethnographic study, has indicated that there is a need for core-EHR solutions that can be used for wider purposes than drug information. This is also in line with other European initiatives. Bernd Blobel [14] concludes that establishment of shared care must be supported by distributed,

interoperable information systems. New information infrastructures which have grown from regional networks into national networks, like the Norwegian Health Net, provide possibilities for better and more secure communication than few years ago. The healthcare providers at different levels do have access to EHR systems, but still the possibilities for exchange and sharing of health information is limited, as also addressed in [9].

The core EHR and the model from the SUMO project can provide a good basis for a more general Norwegian core EHR. The RHA's ICT organization, NIKT, and the Directorate of Health have now initiated projects to evaluate how a core EHR can be established in the years to come. Examples of a wider use of the core EHR can be: shared individual plans to support continuity of care, summary of the patient's contacts with health providers in different organizations, and core-EHR information as important diagnoses, allergies and contact information.

More extensive electronic cooperation and communication, requires that all partners adjust their documentation practices to fit with other actors' needs. The implementations effects on future work practices will be followed by researchers.

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Paper 7

How can the Locales Framework be used as Basis for Design of Collaborative Systems in Shared Health Care?

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How can the Locales Framework be used as Basis for Design of Collaborative Systems in Shared Health Care?

Vigdis Heimly
Department of Computer and Information Science, Design and use of Information System Group, Norwegian University of Science and Technology, Trondheim, Norway
Norwegian Centre for Informatics in Health and Social Care, KITH, Trondheim, Norway
vigdis.heimly@idi.ntnu.no, vigdis.heimly@kith.no

ABSTRACT

The paper addresses the increasing need for collaboration in the Norwegian health sector, and how collaborative systems can be designed to facilitate exchange and sharing of health information. An upcoming national health reform, the coordination reform, will have focus on how patients can get health services in, or closer to, their homes. The change in the cooperation processes between primary and specialized care will trigger the need for better collaboration platforms. Design of electronic collaboration systems in health care has been challenging, and deployment of existing systems has been slow. This paper addresses how the Locales Framework can be used to do an analysis of the current situation and provide a basis for design of future collaborative systems. The framework seems to be adequate for analysis of collaboration processes in the health sector, and as a basis for establishing general recommendations for design of collaborative systems.

KEYWORDS: Locales Framework, Health Care, Design, Awareness, Boundary Spanners

1. INTRODUCTION

Hospitals in Norway are organized under 4 Regional Health Authorities (RHAs). Each RHA is responsible for a group of Health Authorities (HAs) that includes one or more hospitals. The health system is public, but there are also a few private specialist clinics and practices that offer services in competition with the public system. Primary care is the responsibility of local municipalities. Most General Practitioners (GPs) are working in private enterprises, in agreement with their local municipality.

All patients are assigned to **one** GP's patient list. All primary contacts with the health care system, except acute care, should be channeled via the GP. Most patients who are admitted to the hospital have been referred by their GP. When the patient has finished the treatment at the hospital, the normal procedure will be to return the patient to community care under the GPs responsibility.

Costs related to specialized care are rising rapidly in Norway. As people live longer due to improved health care services, more and more citizens will need care on their elderly days. Many people are also saved from a sudden death as early newborns or in traffic accidents, but may need specialized care for long periods.

The hospital administrations want to keep the patient's hospital stay as short as possible in order to reduce costs. Patients who are ready for transfer to primary care and are waiting for admittance to nursing homes, rehabilitation or home care support to be organized, are filling up hospital corridors.

A new coming Norwegian health reform will have focus on how the patient can be provided with improved health services in community care, closer to their homes, and at the same time reducing the need for expensive specialized care. The reform is named "the Coordination Reform".

This health reform is also likely to be followed by economic incentives, and resources will be transferred from the hospitals to the municipalities. The municipalities will have to pay the hospitals according to the number of patients they refer to specialized care, and

there will also be a high cost to pay for patients who have finished their hospital stays, but have to wait in hospital for community care to be organized.

The coming health reform is likely to put more focus on the need for collaboration between actors in secondary and primary care. The expectation of shorter hospital stays and the possibility of rising costs for the municipalities due to delays and prolonged stays will make the need for availability to the right information at the right time more visible than before. The municipalities need to know as much as possible about the when the patients are likely to finish their stay, the expected medical status at time of return and the need for services like transfer to nursing home, home care or rehabilitation services. It is also likely that the GPs will need to consult specialists more frequently than today in order to get a second opinion or advice regarding the patient's medical condition. Easy access to quality assured clinical guidelines will also be essential.

Shared care is cooperative health care across organizational- and often also geographical borders. Shared care will typically involve a diversity of health workers as GPs, medical specialists, nurses, midwifes or physiotherapists. All these actors should work together with a common goal: Better health care services closer to the patient's home. ICT-systems that support shared care can be used in places where health workers from different organizations and patients interact. Design of collaborative systems that can support shared care is demanding, because both an understanding of the nature of the collaborative work processes and the ability to foresee how new collaborative tools can support existing or future work processes are required.

The electronic collaboration between the caretakers in different organizations has so far mainly been based on electronic messaging, but web-based solutions and access to shared core medical information have also been tested. [1]. A cooperation architecture is developed by major actors in the Norwegian health sector. The basic requirements for this architecture are:

(1) all messaging traffic should use the national broadband network, the Norwegian Health Net
(2) only standardized messages should be used
(3) the vendor's message implementations should be approved by the Norwegian Testing and Approval Service at the Norwegian Centre for Informatics in Health and Social Care (KITH)
(4) the ebXML framework should be used
(5) application receipts should be sent for all messages.

The first version of the cooperation architecture is based on messaging, but an extended version of the architecture is also developed for web services.

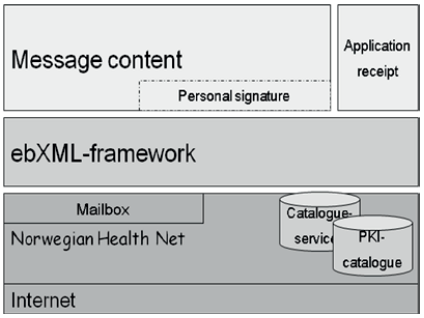

Figure 1. Collaboration Architecture, Message Version

The Norwegian message standards are national standards are based on the recommendations from the technical committee TC251 within the European standardisation organization CEN. CEN/TC251 is also collaborating with HL7 and ISO, and work to harmonize the standardisation activities related to health informatics is ongoing.

The vendors of Electronic Health Record (EHR) systems for use both in specialized and primary care have been provided with limited national funding in order to develop communication interfaces that support the national message standards. The specifications of the user interfaces of the communication modules that are integrated in the GP's EHR systems, have been based on recommendations from a user group that was established by the Norwegian Medical Association. When the implementations have been tested and approved by KITH they will included in the updated overview of the status of the vendor's message implementations. This overview is easily accessible on KITH's website, www.kith.no. The purpose of the website is to make the customers more aware of the EHR system's limitations and possibilities for electronic collaboration.

The expectations of benefits from better electronic collaboration have been high in many countries as exemplified by Cannaby et al. [3] and Bower [4]. An analysis of EHR cases by Dobrev et al. [5] also shows that interoperability and information exchange is a prime driver of benefits from EHR systems. Interoperability is here defined as the ability to exchange, understand and act on patient and other health information and knowledge

among linguistically and culturally disparate clinicians, patients and other actors, within and across jurisdictions, in a collaborative manner. The deployment of electronic messaging in Norway has been much slower than expected, even though all communicating actors have implemented EHR systems, messaging standards are available, communication interfaces are implemented in the EHR systems, and all actors are connected to the Norwegian Health Net. A series of meetings between the RHAs, The Norwegian Medical Association and KITH in 2007 indicated that the reasons were both technical and organizational [2], but as an increasing number of technical challenges have been solved, more attention has been focused on the interplay between organization and the technical solutions.

Further development of collaborative systems is needed, but one of the main challenges is: How can we design systems that support collaboration across organizational boarders in a way that support all actors' needs and work well in daily practice?

Changes in the cooperation pattern will have implications on the involved health worker's work processes. How can we make sure that they get access to the right information when they need it? How can new possibilities for collaboration be used as a means to improve the quality of the information that is shared? How can health workers be aware that new information is present, at how can they make other parties aware that they have added new content that might be of interest? If the work processes are changed, and the workload is shared between the health workers in new ways, how can we assure that the actors trust each other and accept the new changes?

2. METHOD

In order to be able to give some guidelines for further design of such systems, an analysis of the existing situation is beneficial. It is necessary to understand the nature of the work. Collaborative processes often involve actors in many organization that work with complex problems. Various methodologies, both qualitative and quantitative, can be used to get an understanding of the work.

In this case, information about the current situation has been collected by means of semi structured interview [6], [7] with users in two hospital wards and a GP practice. The interviews have been transcribed and analyzed. Participation in meetings with the hospitals and at national workshops and seminars has also provided valuable information is addition to reading of reports and national strategy documentation.

The author has also participated in a collaboration project with a small hospital where a Practice Consultancy System was established as a mean to improve collaboration. Practice consultants are GPs that work in part-time positions at the hospital. This could typically be 2 days a month. Their mandate is to work with improvement of procedures that are related to collaboration between primary and specialized care. Some examples of activities are: revisions of procedures for referrals and making templates for documents that are exchanged e.g. discharge summaries, referral and laboratory reports in cooperation with specialists at the hospital. The practice consultant will also often be used as resource persons in projects where new ICT-solutions that support shared care are introduced. The practice consultant's practice would often be used as a pilot site.

The author has also been administrative project manager of a pre project that established a basis for a national Core Medical Chart project [1]. Experiences from this project have also been to see experiences with electronic collaboration in a broader context.

Qualitative and quantitative data have also been collected through a national survey. A questionnaire was sent to all the 28 HAs. 23 (82%) of the forms were returned, among them the forms from all the largest hospitals. The forms were filled out by different categories of personnel, but most of the respondents were responsible for cooperation departments or were project managers for collaboration projects. The main rationale behind the survey was to find out what the status and plans were regarding electronic collaboration with primary care in general, but more specifically in relation to electronic referrals. Some of the questions gave room for additional open ended comments.

The Locales framework has been used for analysis of the collected information.

2.1. The Locales Framework

Fitzpatrick [8] describes how wicked problem situations can involve people who interact in and with complex contexts involving social, organizational, physical and technical dimensions. She has based her work on input from many different sources in the CSCW-community.

She has defined the Locales Framework that is based on five aspects:

1. locale foundations that identifies the social world with spaces and resources
2. civic structure that identifies relationships of the social world and the locales

3. individual views as different perspectives of the locale
4. interaction trajectories that identify the dynamic and temporal aspects of the living social world and the interaction within and across locales
5. mutuality, identifying the mutual communicative process through which awareness is achieved

The five aspects capture the complexity of the reality and can potentially help to position concepts into a coherent framework. They are thought to support:

- Analysis of work in complex situations
- Design of systems motivated by an interactional rather than technological perspective

These aspects all provide different perspectives or ways of understanding the locale in question, but they are also often interdependent and partly overlapping. The locale is constituted in the relationship between the social world and its use of space and resources.

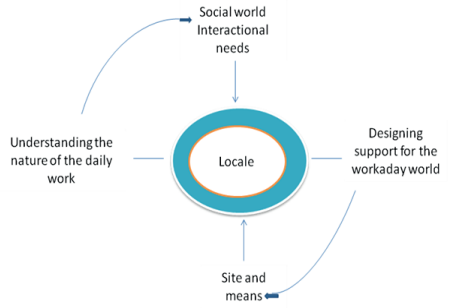

Figure 2. The Locales Framework

Figure 2 illustrates how the Locales Framework connects the social world and the spaces and resources that they interact with. An example of use of the framework is provided in [9]. The authors have been reflecting upon differences between anticipated and actual user behavior when using a system that was designed based on the framework theory.

3. ANALYSIS

3.1. Foundation

The primary social world of interest in the Norwegian health care case is comprised of the health workers, the patient's relatives and the patient, who all share the common goal of better health services closer to the patient's home. More focus on this common goal will hopefully lead to a process with drift from a situation where small groups of people were working together in locales at a local level (hospital, nursing home or general practice) to a situation where actors from the different locales work together in a new locale that is shared, figure 3. The locales to left are social words that are related to physical spaces like buildings, while the locale to the right might be related to a virtual domain.

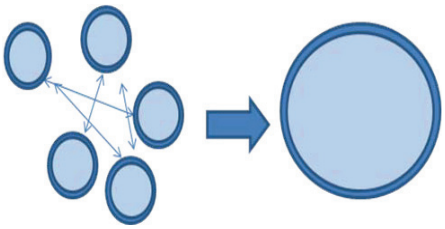

Figure 3. Drift from Communication between Locales to Collaboration in One Locale

Different medical specialties like cardiology, oncology, or pediatrics will probably need their own locales that are shared across organizational boarders. These locales will be partly overlapping.

Infrastructure

The motorway for information sharing and exchange in the Norwegian health sector is available to many actors in the health sector. The Norwegian Health Net (NHN) is a closed secure high speed network that connects almost all hospitals and GPs. An increasing number of municipalities with nursing homes and home care offices are also connected to the net. One of the main uses of the health net is broadband communication between the hospitals, but more and more information is also exchanged between hospitals and primary care. The main challenge so far has been that a very limited number of services are available. The Norwegian health net is a technical infrastructure, but only to a limited degree an information infrastructure. Development of end user services has so far mainly been the communicating parties' responsibility. The new health reform will suggest that NHN shall be owned by the government and not the 4 Regional Health Authorities that operate the hospitals today. This intention is to emphasize that the health net is available for all actors in the health sector. The new NHN will also get an extended responsibility for adding new services to the net. This will probably also include collaborative systems as a national core EHR.

Existing services that are available in NHN are message exchange (discharge summaries, referrals, lab requisitions and results..), web-based systems for requisition of laboratory tests and different telemedicine solutions.

Some tools to support collaboration are present
ICT has been used as a tool to support the clinicians' work-processes in Norway for more than two decades. The first Norwegian EHR systems for use in General Practice were implemented as early as in 1984 [10]. 98% of the GPs have had these systems in daily use since 2001 and EHR-systems are also present at all Norwegian hospitals. These systems started as administrative tools, but have over time emerged to be systems that support daily clinical work-processes. The focus has also changed towards shared care that involves several caretakers in primary and specialized care.

In order to make the trajectories between primary care and the hospital as efficient as possible, there is a need to register, communicate, and interpret the information that is exchanged by all the involved parties. The information can either be sent as a message, the receiver can actively get access to information that is stored by the other party, or the sender can actively register information in a system held by the cooperation partner. It might also be possible to share information in a system held by a third party. The selected technical solution can depend on national legislation, and agreements between the communicating actors.

In Norway the most commonly used alternative is messaging between GPs and hospital (referrals and discharge letters..). A few hospitals use a web-based referral system where the GP registers the referral in the hospitals system. Core EHR-systems that includes the most essential information about medication and contact are at a pilot stage. It is likely that ICT-solutions for sharing of essential health information in core databases will be more common. It is also a trend towards web-based solution that owned and operated by hospital or private actors where there is a strict control both on which input should be registered in the systems and which information should be shared

The deployment process of solution for electronic collaboration has been very slow. The survey that was answered by the hospitals addressed the challenges regarding deployment of electronic referral.

The answers differed a lot from region to region and hospital to hospital. The most significant answers were:

- It is not evident that costs related to introduction of electronic referrals can be justified by the benefits.
- The hospital can receive referrals, but the GPs are not sending.
- It is difficult to integrate new modules for handling of electronic referrals in the hospitals EHR-system, and the hospital awaits new technical solutions.
- The hospital does not want to have a mixed solution of electronic and paper referrals and awaits the GP's initiatives.
- Work processes need to be changed at the hospital, and decisions about changes are needed, but not made.

Dobrev [5] concludes that EHRs and ePrescribing are not quick wins, they are sustainable wins. It takes at least four, and more typically between six to eleven years to realize a cumulative net benefit.

3.2. Civic Structure

Legislation in many countries does not permit doctors at different levels in the treatment chain to share medical information. Information sharing requires the patient consent, and consent based systems are not always practical in daily use. The legislation in Norway is changing very slowly, and is still quite restrictive. The introduction of a proposal for a law change that will permit sharing of core EHR information based on consent has led to heated debates in the media. Patient seem to be very reluctant when it comes to how much information should be shared, and patient organizations seem to be more concerned with the possibility for sensitive information in the wrong hands than the possibility for better treatment if the clinicians have access to the right information at the right time.

Norwegian health workers are obliged to use health records to document the patient contacts. Complaints from the patients about procedure failures and maltreatment is getting more and more common, and thus documentation of the actual treatment and procedures followed is getting more and more important.

3.3. Individual View

The purpose of the information: Documentation for you, me or other actors?
Figure 2 gives examples of some of the involved actors. They all belong to their own social world or locale, but have to work for a common goal in the shared care context and in the common locale. Their main focus is on how to produce and get access to relevant medical information. Medical information produced for use in one context, has to be used by other actors in a different

context. When a person writes information into an EHR, the recorded documentation might be used in several contexts and from different views:

- Documentation as a part of the internal work process that covers the treatment of the patient at the hospital. The hospital stay should be as short as possible, but on the other hand, the patient should also be well enough to not be readmitted within a short period of time. The patient will normally be treated by many doctors and nurses at different shifts, and accurate information about the patient's medical condition, medication and treatment plans needs to be available at a "need to know" basis.
- Documentation for the patient. The patient is getting closer and closer to a customer, and requests access to his or hers own EHR. Many patients even have bedside access to their own EHR. This also means that the EHR-documentation must be written in a language that is understandable for non-experts.
- Documentation for the next level in the treatment chain. The GP would request EHR-documentation that is important for further treatment when the patient returns to primary care. The GP would typically not be interested in details regarding surgery or a cure that was given during the hospital stay. Information about current medication when the patient leaves the hospital is important, and information about the outcome of the hospital stay, scheduled appointments with the specialist and expectations for further treatment in primary care.
- Documentation for reporting to national registers, e.g. a "patient register" with administrative information about hospital stays or quality assurance registers as the Norwegian Cancer Registry.
- Documentation for reimbursement. In Norway hospital get paid from the government according to have many patients and which diagnoses they treat on an annual basis.
- Documentation for research purposes.

As an example from the interviews: The GPs are very concerned with the amount of time that is spent on documentation and the registration process has to be as efficient as possible. Documentation of the outcome of the consultation, suggested treatment plan, scheduled appointments and medication are examples of information that is present in the GP's EHR. His or hers income is likely to depend on the number of patients treated, and the time for each consultation is very limited. If the GP decides to refer the patient to a specialist, sufficient information for making the appointment should shared with or passed on to the actor in question. On the other hand, hospitals are concerned with missing information like X-rays, lab-test and medication. Missing information leads to duplicate tests, possible maltreatment and need for extra appointments.

3.4. Interaction Trajectories

The patient's GP is the gatekeeper to specialized care in Norway. Annually 2 million referrals are sent from GPs. 25% of the referrals are related to cases where the patient is admitted to the hospital immediately, while the remaining 75% results in a contact at a hospitals outpatient clinic or an appointment with a private specialist.

The responsibility for the patient will normally be transferred back to primary care, when the patient has finished treatment in specialized care. The discharge letter will then be sent to primary care from the specialist or hospital.

Many patients will need community care services after they leave the hospital. This can include home care services, a short or long stay at a nursing home or rehabilitation service. The nurses at the hospital will try to get these services organized before the patient leaves. The patient can often depend on the services for a long period. Many patients will also be readmitted to the hospital, and it will then be necessary to inform the service providers that the patient does not need services for a while.

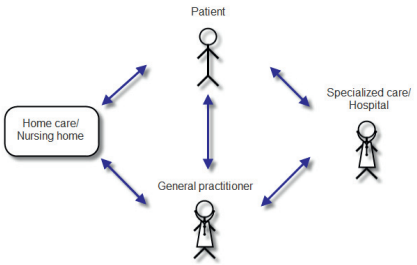

Figure 4. Shared Care

The new health reform will imply that the patient be provided with more health services at the municipal level and fewer in specialized care. This can also lead to a need for more supervision from specialists and increased collaboration between many health providers. The patient

and the relatives are also more likely to be involved in taking care of health related issues.

An increasing number of patients suffer from chronic diseases like diabetes, COPD and chronic heart conditions. These patients will often require services from specialized and community care simultaneously, and it is important that all actors have access to updated medical information about the patient.

3.5. Mutuality

Awareness in collaborative health systems
Souza [11] focuses the problem of "To whom should I display my actions, and whose actions should I monitor"? These questions are highly relevant in shared care because health workers need access to health information that is updated by many parties. Awareness of new content that is added is important, but should on the other hand not be to disturbing in the daily work process. GPs that have been involved in a Norwegian core medical chart project [2] were very concerned that they should be disturbed in their daily work by flags or alarms that were popping up on their screens or interrupting their work processes. They did not want be informed immediately when medication was prescribed for their patients by other doctors, but wanted to check this on a list at a daily basis. The GPs were also not interested in information about cures that were prescribed by the specialist for a short span of time. (As an example: Antibiotics for treating some kind of infection)

Enough, but not too much information
The doctors also only want to have access to the information they need, and not all the information that could possibly be available about the patient. A better structure of the medical record and better possibilities for filtering of information could have helped on this problem, but unfortunately most of the EHR-information is just a big lump of free text. Important information can be hidden in the hospitals EHR-information, but the GP does not want to have the responsibility for searching through all this information in search for something he or she does not even know is present. Instead of sharing all information, doctors seem to be more satisfied with getting the information they need transferred as an abstract, or getting access to some core information about the patient as current medication, diagnoses, allergies and updated demographic information.

Trust
Trust is important in collaborative work, but it is a challenge for health workers, as for most other people, to trust others recommendations. This can particularly seem difficult when you interact with people that you do not know very well. As an example, the waiting list coordinator commented during an interview that a project where GPs could refer patients directly for hernia surgery was terminated because there had been several cases where the hernia could not be found when the patient was admitted to the hospital. The specialists at the hospital meant that the GPs were not qualified for choosing patients for surgery. In interview with a representative from the hospital management later, it was on the other hand claimed that "missing hernia" would also often be the case even if the patient was admitted via the hospitals outpatient clinic, and that the problem was not necessarily related to the GPS competence.

Practice consultants as boundary spanners
Boundary spanning primarily concerns the exchange of information [12]. A boundary spanner is defined as one who attempts to influence external environmental elements and processes. Levina and Vaast [13] and Orlikowski [14] have also studied how organizational competence emerges in practice, and how actors in a new joint field develop interests in spanning boundaries and eventually transforming knowledge. The practice consultants can be seen as boundary spanners who can bridge general practice and specialist services in health care.

The practice consultants were first introduced in the Fyn region in Denmark in 1991. Practice consultants are General Practitioners (GPs) that work in part time positions (10-15%) at the hospital. 10% of the GPs in Denmark held a position as a practice consultant in 2002 [15]. 100 practice consultants and 27 hospitals were included in the Norwegian Practice Consultancy System in 2009. When the practice consultant is present at the hospital he or she will work with issues that are related to collaboration across organizational boundaries.

As an example of how the practice consultants work, a survey by a group of Norwegian practice consultants [16] showed that 37 % of the referrals had insufficient information. The Norwegian practice consultants have on basis of the study and in cooperation with the specialists at the hospital made a checklist for the referral process that can be used by the GPs. A new study will follow to see if the referral practice has improved after the new requirements are effectuated.

The health workers in different organizations seem to need to get a better understanding of the cooperating actors work processes. Norway has so far had positive experiences with practice consultants. According to the survey to the hospitals in 2008, 75% of them have practice consultants, and the hospital reported that they have good

experiences with their effect on improvement on collaboration.

4. RESULTS AND RECOMMENDATIONS FOR DESIGN OF COLLABORATIVE SYSTEMS IN HEALTH CARE

The Locales framework has been used as an aid for analysis of the current situation in the health sector in Norway. Some guidelines for further design of collaborative systems are provided based experiences from ongoing work.

Expect slow deployment and allow for parallel systems
So far, the main means of communication between actors in the locales in the health sector have been phone, paper and electronic messaging, but systems where actors can share information and communicate more synchronously are becoming more and more common. Due to the nature of work in health care [17], it is still likely that many of today's communication types will be kept up in parallel with electronic collaborative systems, and that the replacement will happen slowly [5], [18].

Norway has a large installed base of EHR systems. New collaboration services must to be easy to access from the practitioners EHR systems and not be standalone systems. Pilots do not necessary have to be integrated with all EHR systems from all vendors at an early stage, but it is essential that pilots have a potential for deployment and adheres to cooperation architecture requirements and national strategies.

Context is important
Information that is supposed to be shared, needs to be suited for the context in question. The referral can be seen as example of a boundary object [19]. A generalized version of the referral has been established as a standard that can be used as a basis, but interviews with users at the hospital and GPs have indicated that specialized referrals might be needed in different locales. The locales can be related to specialties like rehabilitation, urology, cardiology or physiotherapy. It is important that the actors easily can access information that they need, but they must not be overloaded with too much information. Collaborations systems need to develop over time and the boundary objects related to them are also likely to change and need to be adjusted to local needs of the collaborating actors. Standards developed by standardization organizations as CEN or ISO and national standards are important as a basis for the boundary object, but the actual use of the standard in the context in question, must be agreed at a local level. As an example, an XML-format standard for referrals can be used for exchanging different types of referrals as referrals for rehabilitation, physiotherapy or clinical surgery. Different subsets of the standard may be used in these cases.

Make sure that collaborating actors have a joint understanding of each other work processes
A common understanding of the needs of actors who are going to share the health information should be developed over time, and could also imply changes in both specifications of data, user interfaces and technical solutions. It is also important to get to an agreement between the different actors who are involved in the collaboration. The need to "see each other" by making each other's activities and needs visible [20]. The tension between doctors in primary and is likely to remain, and it is not evident that new technical solutions will be more used than the existing ones if they do not support the health workers work processes to a sufficient degree at all levels.

The practice consultants should be used actively in order to get better awareness of the GPs needs at the hospital side, and to get better awareness of the specialists needs at the GPs side.

The system must the trustworthy
The interviews showed that many GPs fear that electronic messages or information that is shared in a core EHR will not be read by collaboration partners or get lost. This implies that mechanisms for securing that information is transferred and read must be in place. The ebXML framework is designed to support secure transfer of information, and should be used actively when designing new XML based applications. Systems for logging and handling exceptions should be present and application receipts should be used.

New collaborative systems in health care should be designed with functionality that helps the actors to get aware of other actors' actions, but care should be taken in order to not overload health workers with interruption and messages that are not important to their work processes. Cabitza and Simone [21] show some good examples of how supportive technology can provide actors with awareness information about other actors' use of work conventions in a document-mediated collaboration.

Use practice consultants as boundary spanners
Extended use of practice-consultants can be beneficial for a better understanding of other actors needs and establish trust across organizational borders. This includes work with procedures and guidelines that need to be shared among a group of actors. Guidelines should possibly be

made available as decision support in the clinicians EHR-systems. It is important that these guidelines are easily available, but that they also do not "clutter" the clinician's workspace. Practice consultants should play important roles as boundary spanners in both the design of new systems and the deployment.

5. THE FUTURE OF COLLABORATIVE SYSTEMS IN HEALTH CARE

Electronic collaboration in the Norwegian health sector is at the moment based on use of electronic messaging. Systems that are based on web services and include decision support possibilities and provide services to the patient are in pilot use. These systems are likely to diffuse and replace the existing solutions over time, but the experiences so far show that they way from pilots to national solutions in long and tedious. Deployment of the standardized message based solutions should go in parallel with development of the next generation systems.
The Locales framework seems to be adequate for analysis of collaboration processes in the health sector, and as a basis for establishing general recommendations for design of collaborative systems in the health sector. As experiences from pilots grow, the Locales framework model in the paper could also be extended, and used as a basis for designing new collaborative systems.

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Paper 8

Step by step, Climbing the stairs from the introduction of electronic health records to electronic collaboration,

Mediterranian Conference on Information Systems, MCIS 2011

STEP BY STEP

Climbing the stairs from the introduction of electronic health records to electronic collaboration

Vigdis Heimly [1,2] , vigdis.heimly@idi.ntnu.no

Eric Monteiro [1] , eric.monteiro@idi.ntnu.no

1. Department of Computer and Information Science, Design and use of Information System Group, Norwegian University of Science and Technology, Trondheim, Norway

2. Norwegian Centre for Informatics in Health and Social Care, KITH, Trondheim, Norway

Abstract

Collaboration across organizational borders is often needed. Experiences from some of the electronic collaboration projects that have been initiated in the health sector show that it is challenging to establish solutions that are sustainable and can be deployed in wide scale. The case in this paper is from a medium size hospital in Norway where electronic collaboration related to referrals has been introduced through a stepwise process. The first step was to introduce traditional electronic messaging. The next step was to implement decision support in order to improve the quality of the referral. The following step will probably be a dialogue based support where general practitioners and specialists can communicate about patients, and where the dialogue is kept as a part of the patient's electronic health record. This paper sums up the findings after the introduction of the decision support system. The results from the first steps are promising, but they also show that it is a sociotechnical interplay between the different actors that need to be balanced in order to establish a solution that will be used by all actors.

Keywords: Electronic referral, deployment, electronic collaboration, boundary spanners, stepwise process, quality, decision support

INTRODUCTION

The potential of ICT to enhance efficiency and quality of healthcare delivery through collaboration is well rehearsed (Hasman, Ament et al. 1992), (Stroetmann, Jones et al. 2006), (CANNABY, WESTCOTT et al.), (Harno, Paavola et al. 2000). Still the collaboration across geographical, institutional and/ or professional boundaries all too often rely on inaccurate, inconsistent, (partially) irrelevant or outdated information. The development, use and widespread deployment of collaborative ICT in healthcare in Western countries lag significantly behind ambitions and plans. (Greenhalgh, Stramer et al. 2010), (Bal and Mastboom 2005), (Pothier, Awad et al. 2006), (Heimly 2008; Heimly 2009).

Against this background of a rather bleak track-record to date, we report from and discuss a project to improve collaboration between general practitioners (GPs) and hospitals that has been welcomed by the clinicians. The aim of the paper is, without resolving to "critical success factors", to discuss the crucial importance of attention to *detail and a stepwise approach*. If the Devil resides in the details, the opposite also holds true. For instance, rather than reiterate the need for adequate training for the users, we analyse the form, timing and location of this training i.e. the way training is situated. This ia also in line with findings T. Greenhalgh and her researchers did in their evaluation of the SPINE project (Greenhalgh, Stramer et al. 2010).

1 COLLABORATION IN HEALTH CARE, STATUS AND CHALLENGES

Norway has a public health care system, but some private health care actors are also present in the market. Each citizen is assigned to one GP's patient list and the GP is the gatekeeper to specialized care.

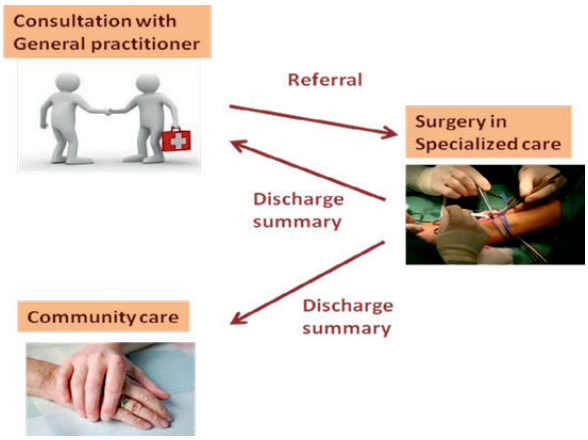


Figure 1: Communication between primary and specialized care

The GP decides whether the patient needs to be referred to specialized care or not. Primary care is the responsibility of the municipalities. Specialized care is organized within four regional health authorities that are funded by the Department of Health. When the GP decides that the patient needs to be transferred to specialized care, a referral will be sent to a specialist who will review the referral and decide what kind of further actions need to be taken. The specialist will consider the patient's rights according to legislation, and will give the patient priority on the waiting lists based on the information

that the GP has provided in the referral. When the patient has finished treatment in specialized care, a discharge summary will be sent back to primary care from the specialist. The document is written or dictated by a specialist and contains information about: diagnosis, finished treatments at the hospital, current medication, planned appointments in specialized care and proposals for further action in primary care.

This process has traditionally been paper based, but since specialists in hospitals and GPs use electronic health record systems as a means to support their daily work processes, electronic referrals and discharge summaries have been introduced.

The figure illustrates some possible steps in the process of implementation electronic referrals. Many Norwegian hospitals have started by scanning the paper referrals into their EHR-systems. At the same time GPs have produced paper referrals from the EHR-systems. The referrals have been sent by ordinary mail to the hospital.

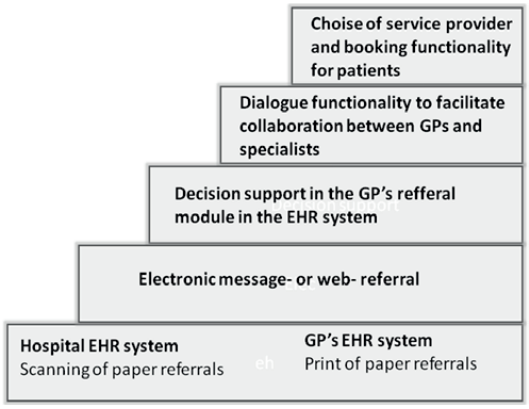


Figure 2: Steps in the introduction of electronic referrals

The next step has been message- or web-based electronic referrals. Decision support assisted by guidelines have been tried out in order to improve quality of the referrals in some projects like Zorg Domain in the Netherlands (Bal and Mastboom 2005) and the Referral Hotel project in Denmark. Further steps can also include functionality that can support a more direct dialogue related to referral that includes both specialist and GPs. Patient can also be provided with software that can be used for booking and choice of service provider. Examples of projects where patients have been involved are the Choose and Book project (Eason 2007) and also again the Danish Referral Hotel.

Standardized health messages, based on international standards from the European standardisation committee CEN/TC251, have been available for the Norwegian Health actors since the mid nineties, but the deployment process has been slow. This has proven to be due to both technical and organizational reasons (Heimly 2008). Experiences from other countries show a similar pattern (Heimly 2009).

2 THEORY

Systems that are intended for collaboration across organizational borders are challenging to design, develop and deploy because many stakeholders with potentially different interests are involved. Issues like how can we best ensure that the collaborating actors have a joint understanding of each other work processes, and how can we make sure that all the involved parties get some benefits are cruicial (Heimly 2010; Heimly 2010), but how do we do this in practice?

According to Berg (Berg, Aarts et al. 2003) sociotechnical approaches aim to increase understanding of how new information systems and communication technologies are developed, introduced and can become part of social practices. Berg suggests that the largest challenge for the sociotechnical approach is how to interrelate the nature of health care work with the characteristics of formal tools.

As an example of a tool that did not fit daily practice Winthereik and Vikkelsø (Winthereik and Vikkelsø 2005) describe how discharge summaries from the hospitals do not "fit" with general physcian's demand: they have to manually rework (filter, delete, rewrite) the discharge summaries to fit their own agenda of deciding what to do with their patient next.

Carlile (Carlile 2002; Carlile 2004) describes progressively complex processes (transfer, translation, transformation) at the three corresponding levels in a framework for managing knowledge across boundaries. Levina and Vaast (Levina and Vaast 2005) have also studied how actors in a new joint field develop interests in spanning boundaries and eventually transforming knowledge.

According to Munkvold and Ellingsen (Munkvold and Ellingsen 2007) it is important to develop mechanisms that strengthen the relationships between different nodes in trajectories in health care. In order to bridge the gap between primary care and specialized care, many hospitals in Norway have employed practice consultants (Heimly 2010) (Kvamme, Olesen et al. 2001; Kvamme, Olesen et al. 2001). The practice consultants are boundary spanners who work as GPs in primary care, but also have a part time position in specialized care. Their role as practice consultants in specialized care is to work with issues that are related to collaboration across organizational borders. Typical work tasks would be to ensure that referrals and discharge letters are structured in a way that benefits the communicating actors both in specialized and primary care.

3 CASE

3.1 The project site

In this paper we address experiences with the first steps in the introduction of referrals a hospital that in the following text is called HOSPA, in Southern Norway. The hospital moved to a new site in 2008. As part of the building process for the new hospital, some funding for development of ICT solutions to support collaboration between primary care and the hospital was also provided.

Already in 2006/2007 a project that intended to deploy standardized messaging of discharge letters and referrals was initiated. At the time when the first project was evaluated (Petersen 2008), electronic discharge letter were in widespread use, but electronic referrals were only in limited use.

One of the experiences from the first project was that the introduction of electronic solutions did not necessarily mean that the quality of the referrals was improved. It was recommended to initiate a following deployment project that also included decision support for the GPs.

3.2 The patient trajectory

An illustration of the hospital internal trajectory for a case where the patient is referred from primary to specialized care is shown in figure 3.

The figure shows that the patient might have to go to the hospital for 5 visits before the actual surgery can take place. This is a process that requires a lot of resources from the hospital, and the patient does also have a long waiting time before he or she finally can be admitted for surgery.

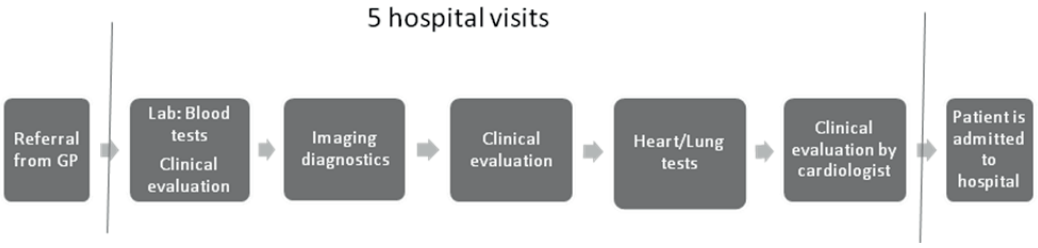
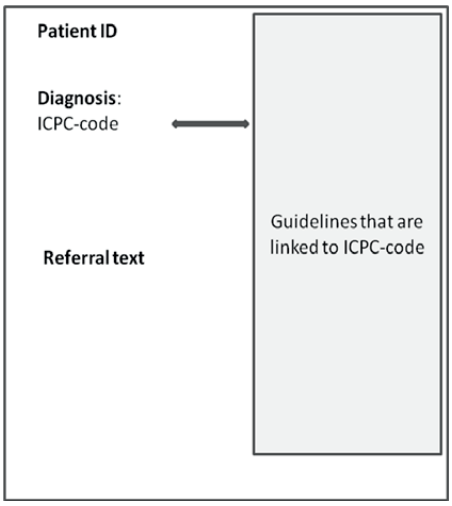


Figure 3: The patient's visits to the hospital

3.3 Introducing clinical guidelines



The idea behind introducing clinical guidelines in the GPs EHR system was that the guidelines could prevent the GPs form referring patients who did not need to be treated by a specialist, and also ensure that necessary results from laboratory tests and image diagnostics were made available to the specialist. This could reduce the number of visits needed, and also reduce hospital costs per patient.

Two wards were selected for the project: Urology and Gastro. The basis for the selection of these wards was that they requested improved referral quality, the specialist showed interest in the project and that there had also been complaints from the GPs about the hospital service level regarding waiting time for the patients and feedback in the referral process. A pre project for a decision support project was therefore introduced in parallel with the deployment of traditional electronic messaging.

Figure 4: Guidelines in the EHR system

3.4 Technical solution

The referral is produced from the GP's EHR system, partly based on information that has been written in the patient's record and additional information that has been recorded in the referral module that is an integrated module in the EHR-system . When the GP decides to refer a patient to specialized care, information from the patients EHR will automatically be transferred to the referral form. This includes information about current medication, family history and present status. Once the relevant diagnosis code is filled in, a window with relevant guidelines will show up on the right side of the screen, if such guidelines are available. There is no strict control on whether the GP follows the guidelines or not, they are only made as a support in their daily work process. The referral is then sent as an electronic message to the hospital. There is technically no difference in how the referral message is sent if the decision support has been used or not.

The guidelines are maintained in a web-based tool that is available for the specialist at the hospital. When a new guideline is updated at the hospital, it will also immediately be made available in all the

GP's EHR systems. The guidelines are linked to ICPC (International Classification of Primary Care) codes. Some guidelines are only linked to one ICPC-code, while others are linked to a group of codes.

The guidelines are based on international guidelines and recommendations, but they are also to some extent adjusted to local needs. The specialists originally wanted the guidelines to be more extensive than they are today, but the user representatives from primary care pinpointed that a maximum number of five bullet points can be expected read in every guideline. The decision support module was installed in six general practices. As an average, 5-7 GPs work in each general practices, and the intention was that all the GPs should start using the system.

4 METHOD

4.1 Approach

The project management wanted an evaluation report in order to decide what further steps should be made based on the experiences from six locations. The study was initiated by the project manager and steering committee of the project. The work was done in the winter/spring of 2010 and started 6 months after the GPs had started to use the module that included decision support. The main focus was on the current step on introducing the decision support, but information about the first steps of the introduction of the message based electronic referrals and further expectations for electronic referrals was also gathered.

A qualitative approach was used because the intention was to get hold of information about the GPs daily use of the system and how it interrelated to their work processes.

4.2 Data collection

The work has been based on:

- Participation in meetings at HOSPA and notes from these meetings. This includes a meeting in the steering committee, a project group meeting and meetings with project members at HOSPA.
- Group meetings with the GPs at their local practices. All the GPs who were present in the office participated together with project group members from HOSPA. The project staff from HOSPA included project manager, technical staff and preferably also one of the practice consultants or GPs who had been active in the project. The meetings started with a brief presentation from HOSPA, but apart from that the GPs talked about the experiences they had with the system so far and ask questions about issues they were unsure of, or things they wanted to be improved.
- Semi structured interviews with:
    - Administrative staff that is responsible for handling of the referrals when they first reached the hospital.
    - Specialists who had been responsible for the development of the clinical guidelines.
    - GPs who had been participating in the project as user representatives or practice consultants.
    - GPs who have experiences with use of the decision support system in their daily work

The GPs work in general practice locations, and there are usually 5-7 GPs who are employed at each location, but they are seldom present at time same time. All the GPs who were present at the time of the visit were interviewed, regardless of what their role in the project had been. A total number of 20 GPs were interviewed.

The interviews were semi structured. That means that the GPs were free to provide all the input that they wanted about experiences with the project, but some questions were asked to all GPs. Examples of such questions were:

- To which actors do you send electronic referrals and what is the volume?
- Which improvements do you think should be made to the existing electronic referral system?
- Do you collaborate with the practice consultants and which results do you eventually see from their work?

- What do you think of the collaboration with the hospital regarding referrals, and how could it possibly be improved by means of ICT-support?
- What are your experiences with the technical solution?
- What are your experiences with use of the national recommendation for content: "The good referral"?

The GPs were also asked a set of questions that were specifically related to the use of the clinical guidelines. The results from this part of the study are analyzed in more details in a separate paper (Heimly 2011) but a summary of the results is also included in the results chapter in this paper.

The GPs were often very busy, and the interviews were done between patient visits or during lunchtime.

Meetings with the representatives from the HOSPA and the GPs were held as lunch meetings at the GPs premises. HOSPA provided lunch and came to visit on days when the GPs had announced that they were not too busy.

5 RESULTS

The interviews showed that the GPs were positive to the use of electronic referrals in general and preferred to use them if they had an option to send electronically instead of paper referrals.

The GPs were mostly positive to the way that the hospital had handled the relation to them during the design, development and pilot phase. The GPs said that the collaboration between the project team and the general practices had been good. The GPs felt that they had got the help they needed, but the bugs had also been so few that they did not have to spend a lot of time on contact with the hospital. They had been involved through their representatives (practice consultants and one GP that worked part time in the project team). Even if the GPs had not directly been in contact with the practice consultants, they signalled that they trusted them as their representatives.

The GPs pointed out that it was very important that the system could be adjusted to their needs and that the requirements from the specialists should not restrict the way they wrote their referrals too much. Two of the comments were:"Even if you refer two patients for the same diagnosis, the cases can be very different. It is therefore meaningless to have a predetermined set of questions that must be answered. It should be the GP's decision to provide the relevant information. If not so, the system will not get out of the testbed". "The specialists at the hospital have had to understand that a two-page overview with information that in nice to have is not going to be produced by the GPs. It must be information that is summarized and to the point. If the requested referral process is too time consuming, other hospitals than HOSPA will be preferred".

As a basis for how the GPs and specialists should use and understand the electronic referral form, a national recommendation called the "Good referral", has been developed by GPs and specialists based on a consensus process. The GPs were encouraged to use this recommendation for content. The interviews showed that with a few exceptions the GPs used this recommendation and were satisfied with it as a basis. Comments from the GPs were:

- The structure is ok, and the template is well integrated with the EHR system.
- It suits with my needs.
- I have not heard any complaints and I think all the GPs here use it.
- It works well.

One of the GPs suggested a change to the recommended order of the elements in the structure and wanted to put the actual description of the patient's current problem more up front.

The GPs had limited education in use of the system. It was commented that the system was very simple to use, and the GPs did not have to spend a lot of time on education. Representatives from the project team had visited for lunch meetings, the GPs had assisted each other to some extent, but most of all the users relied on that the user interface was easy enough to use without spending time on education. A few of the users had experienced problems with the system that had been solved with

assistance from colleagues, and one had stopped using the system because he did not want to spend time on solving the problem, but overall the technical solution seemed to work well and was trusted. Some of the GPs even trusted the system so much that they expected that all referrals would go through the system without errors, and one if the practices did not even check the log to see if all application receipts had been received from the hospital.

In theory patients in Norway has a free choice of hospital, but in practice both GPs and patient select the local hospital as their first choice unless the waiting lists are exceptionally long. This is line with experiences that Green et. Al. found when they asked patient about their use of the Choose and Book system in England (Green, McDowall et al. 2008). This would often also save the GPs from spending extra time in contact with a hospital where they are not familiar with the internal organization, and the referral process can also be more time consuming. As an example one of the GPs told of a patient who had a grandmother who lived close to another hospital, and that she (the GP) had to send the referral to this hospital first, before the patient finally wanted the referral to be redirected to the local hospital.

Many of the interviewed GPs had a good relation to HOSPA because they had worked there themselves or because they had a long term relationship with HOSPA and had a trust in that they offered high quality services. On the other hand HOSPA, had a reputation for long waiting lists for patients that were referred to the gastro department. One of the main reasons why HOSPA had chosen Gastro as one of their pilot wards was that they wanted to provide the GPs with better service from this department and hopefully attract more patients that were handled by private specialist today. During the pilot period this strategy did not seem to work. The interviewed GPs still referred many of the cases that did not require acute surgery at the hospital to private specialists. The interviewed GP told that this was mainly due to the long waiting time for the patient. They did not have any objections to the quality of the services from the hospital, but improved possibilities for electronic collaboration did not make them change service provider as long as the waiting times still were longer.

With a few exceptions, all of the GPs had used the decision support system. Some of the positive aspects they mentioned were:

- They felt more confident about which patients they should refer to specialized care and which cases they were expected to handle at a local level.
- Useful to have guidelines on which test that should be analyzed prior to referral.
- The level of the decision support was not too detailed, and they could decide by themselves if they wanted to adhere to the guidelines or not.
- Focus on the decision support system lead to extended use of electronic referrals in general.

Some negative aspects with the current version of the decision support system were:

- Some GPs write the referral after the patient has left the office, and the decision support would then be available too late in the work process.
- The current version of the system offers a very limited number of guidelines. Guidelines are needed for other specialties than gastro and urology, and some of the more general guidelines should also be connected to more than one ICPC code.
- Experienced GPs say that they seldom need the guidelines

It was noted as important that the GPs liked the solution because it was not compulsory to fill in a number of predefined fields. The guidelines were just optional guidelines, but most GPs found them useful. The GP's representatives in the project team had pointed of that the it was important that the system should not require more time to be used for the referral process than before the system was introduced. This is in line with findings in a study from the UK (Rabiei, Bath et al. 2009) where the GPs were reluctant to use the Choose and Book system because of additional workload.

The GPs did also not have a good understanding of whether the results of their use of the clinical guidelines were important or not. Some of the GPs had a clear understanding of that if their use of the guidelines could improve the quality of the referrals and thus influence on the time span until the patient was admitted to specialized care, they should use the guidelines. Many of the GPs on the other hand told that they missed feedback from the hospital: "It is difficult to improve your work, if you do not get any feedback on what the expected quality requirements from the specialist are". The hospital

on their side also said that they had too little time for asking for supplementary documentation or providing feedback on missing information or misunderstandings regarding addressing. In many cases the result was that the patient was scheduled for an appointment at the outpatient clinic that might have been unnecessary if the quality of the referral had been better. “It is an ongoing dialogue inside the hospital about the low quality of referrals” was one of the comments. The GP would sometimes need to add additional information after the referral was sent. This could include new test results or a notification about changes is the patient’s status that could indicate that the patient should be prioritised. Sometimes the GP would also like to request what the status of the referral was. In rare cases the referral had also become lost at the hospital site.

Many of the GPs told that they also used the referrals for sending requests about a referral that was already in the system or additional information about the patient. This initiated problems in the receiving end, because more manual work was needed to sort out which documents were updates or questions related to referrals. As one of the GPs said: ”In the future I would like to see what the status of the referral is at the hospital. Then I can communicate this to the patient. I would also like to communicate directly with the specialist who is responsible for the patient at the hospital.”

The specialists who were interviewed at the hospital would also like to have the possibility to request more information about the patient electronically. This could include more information about the patients function level in order to decide if the patient was likely to need to stay an extra day at the hospital before/after surgery or additional test results.

6 DISCUSSION

Because HOSPA to a large extent installed most of the ICT systems at their new site from scratch, they did not have the same installed base of ICT systems that had been developed and extended over a long period, as many actors in Norwegian health sector have. The introduction of electronic referrals had already started two years prior to the introduction of the decision support project. Many of the GPs had originally been sceptical to the electronic referrals. As the system had been in use for a while, they started to trust the technical solution. This first “simple” step seemed to be an important basis for further deployment of the decision support system. The next step is planned to be the implementation of a dialogue tool.

The electronic referral can be used as an example of a boundary object in relation to Carlile’s framework: format standards for referrals developed by CEN, ISO or other standardization organizations will be at the bottom layer. The semantic layer will consist of interpretations of the standard for daily use, where clinicians and other health workers have made agreements on which information they exchange. At the pragmatic level, different interests among actors have to be sorted out and may lead to changes in daily work processes. Bal et al (Bal, Mastboom et al. 2007) describes how referrals can influence the integration of those two domains. “It does so, however, not through the technical application, but because this application forms a new shared object in the context of which ideals of integrated care can be further developed and actors are able to get hands-on experience.”

This can also be seen as a process where agreements about standards and the implementation of infrastructure and EHR systems are building blocks that are a basis for deployment. At the same time theses building blocks are not necessarily fixed, and changes would often be needed, especially if the project is a pilot or one of the first to use this basis. If so, the development of the standards would often also be a part of the projects and to a large extent influenced by the users’ requirements.

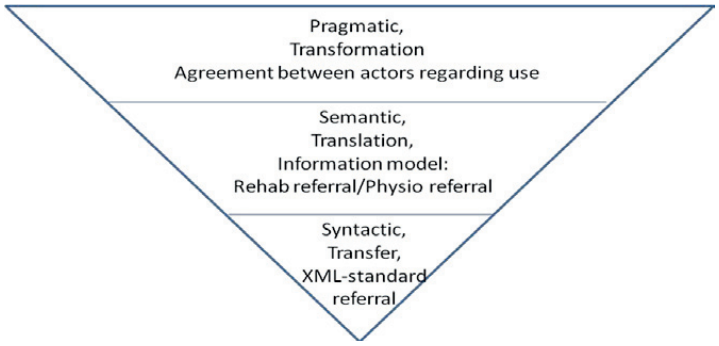


Figure 5: Boundary Framework, Referrals

At the semantic layer, agreements about which information that is needed and how this should be interpreted need to be made. Although not all GPs in the project use the "Good referral" as a basis for the work, the interviews indicated that most of them do. Still this is only a general recommendation, and adjustments at a local level can be needed as indicated by the GP who wanted to change the order of the elements in the structure. It should also be considered to develop recommendations for extension of the "Good electronic referral" for the different specialties at a local level as long as there are no national recommendations.

One of the main findings from the case, was that there is not a common understanding of how the GPs would like their referral solution to be, because their work processes differ a lot, even within the same practice. Some GPs write the referral when the patient is in the office while others write the referrals at the end of the day. It also varies if the GPs use clinical guidelines actively in their work, and how they communicate with the patient. This relates to requirements from the GPs about flexibility in use and that there should be no mandatory input controls to check whether the guidelines have been followed or not. It seems to be a difficult task to standardize the GP's work processes, and it is probably also a better option to let the ICT-systems be flexible enough to support different work processes.

The mismatch between expectations from the hospital and the GPs might partly be solved by ICT-support as clinical decision support, but a better understanding of each other's work process and need across organizational borders is also needed. Practice consultants and the GP in the project played an important role as boundary spanners in the design phase to ensure that the system would be usable in general practice. The GPs trusted them as representatives for themselves. As a consequence, the practice consultants should probably also be given a more visible role in communication of the hospital's needs back to primary care. This should be done in collaboration with the hospital.

As a success factor for further development and deployment of the system, one of the GPs said: "Ownership to the solution is essential. Even if it is the specialists who have the most benefits from the system in terms of better referral quality, it is essential that the GPs feel a strong ownership. If the specialist will be the future owners of the system, the GPs will probably dislike this and not feel so committed to use the system. It would be better to give the ownership of the system to the GPs who work as practice consultants at the hospital, or the GP who has a special responsibility for collaboration issues at the hospital".

Building the basis for an improved collaboration between the actors can be seen as a stepwise process.

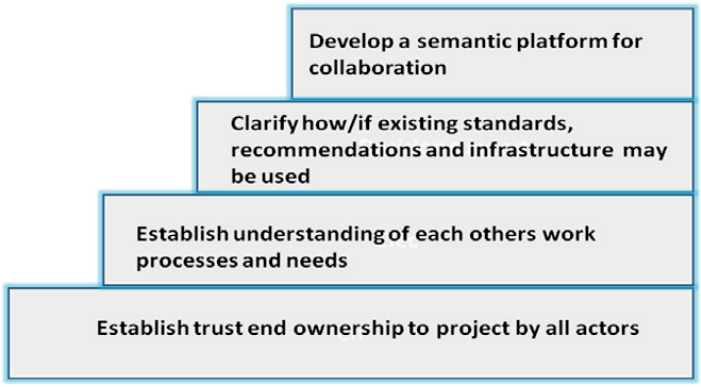


Figure 6, stepwise collaboration

If the bottom steps are not present, it will be very challenging to develop collaboration system the will adopted by the involved actors.

7 CONCLUSION

HOSPA seems to be successful with their deployment of electronic referrals despite that many other Norwegian hospitals struggle with their deployment. All GPs except from one said that they preferred to use electronic referrals when they could. Traditional electronic messaging has been the first step, followed by a slow move towards the solution supported by decision support. Based on the feedback from the GPs, it seems like the focus on electronic referrals in general in the project, has led to a situation where electronic referrals are preferred also when decision support is not available.

There can be small differences between projects that are adapted by the users, and projects that fail. In this project it seems like a rather slow, but stepwise approach has been successful. The technical solution supports most the GP's work processes in a good manner. The involved actors also seem to trust each other and most of them see benefits of using the electronic referrals. The use of practice consultants as boundary spanners and active representatives in the project may also have led to a situation where the GPs feel a stronger sense of ownership and commitment to the system.

When it comes to further development of the decision support solution, more guidelines are requested. Clinical guidelines should also be developed for the other specialties at the hospital. There is also a need for extended collaboration about additional information to the original referral and requests around status of the referral. The next step will probably be to extend the system with a dialogue based service, where GPs and specialists can communicate about the patient cases.

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