



***THE ROLE OF ELECTRONIC NURSING
DOCUMENTATION
FOR CONTINUITY OF CARE
IN SHORT-TIME WARDS***

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Abstract

This paper provides an understanding on the role of the electronic nursing documentation, as an integrated part of the Electronic Patient Record (EPR) in a heterogeneous work practice hospital unit characterized by short-time stay. The aim is to find what role the electronic nursing documentation plays in the communication and collaboration between health care professionals and the different wards involved in the investigation process of cardiac patients. Further, the focus is on what long-term impacts the electronic nursing documentation has for nursing communication and handovers.

This is a qualitative study conducted three years after the implementation of electronic nursing documentation at the Cardiology Department at the University Hospital of North Norway. The sources for this research material are participant observations of the work flow, semi-structured interviews, informal talking and literature review. The notion of Information Infrastructure is used as the theoretical framework for the analysis of the EPR and nursing documentation as an information system. The elements and the interplay of the work practice are interpreted and analyzed through application of Actor-Network Theory (ANT).

For continuity of care in the process of cardiac catheterization, electronic nursing documentation presents performed interventions and delivers important information for the actors involved. A long-term impact from the implementation of electronic nursing documentation in the cross-disciplinary work related to cardiac catheterization is better access to relevant nursing care information for all parts of the treatment chain.

Key words: Actor-Network Theory, Continuity of Care, DIPS, Electronic Patient Record, Electronic Nursing Documentation, Information Infrastructure.

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1. Introduction

One of the main concerns for Norwegian health care services is to maintain cross-disciplinary continuity of treatment and care for the patients. There is an on-going national strategy for improving the electronic coordination and cooperation in health care and the main purpose is to improve the exchange of information between different actors in health care services (Te@mwork, 2007). The national strategy has the following mission statement:

“Patients and clients shall experience continuity of care when using health services.” (Te@mwork, 2007)

Information technology plays a large and fundamental role in management, distribution and storage of information in health care. Interdisciplinary access to health information is expected to increase the quality and continuity of care and treatment of patients (Hellesø & Ruland, 2001). When health care services are increasingly becoming fragmented and specialized with a demand for efficiency, the introduction of the EPR has had an important role for coordination (Munkvold & Ellingsen, 2007). The EPR represents the main central information and communication tool for health care professionals (Hellesø & Ruland, 2001).

In health care services, nurses represent the largest profession and are often referred to be the ones who weave together the many facets and create order in the work environment (Ellingsen & Munkvold, 2007). Nurses have a long tradition for documenting nursing care in patient records, mainly in hand-written kardexsystems. During the last decade pen and paper has been replaced by electronic nursing documentation in most Western countries (KITH, 2003). In the transition, the nursing documentation has gone from being a separate hand-written system to becoming an integrated part of the EPR. According to Ellingsen and Munkvold’s (2007) study in a ward with long-time stay, there were high expectations that the

implementation of electronic nursing documentation would contribute to an increased level of integrated care. They found the nurses had problems with integrating the nursing process into the nursing documentation, and that made the contribution from the electronic nursing documentation disappointing. Further, they found that the nursing documentation worked well as a documentation tool, but it was in limited use in practice, such as in nursing handovers and meetings.

Manias and Street (2000) describe the nursing handover as a medium of communication where the tradition for oral overlapping in shifts is old and strong. They further emphasize that the nursing handover involves a complex network of communication that impacts on nursing interactions.

Nursing documentation is an important element for the exchange of nursing care information and in the planning of nursing interventions.

“Communicating nursing care during the patient's total hospital stay is a difficult task to achieve within the context of high patient turnover, a lack of overlap time between shifts, and time constraints. Clear and accurate communication is pivotal to delivering high quality care and should be the gold standard in any clinical setting.” (O’Connell & Penney, 2001)

1.1 Purpose of the Study and Research Questions

In order to study the communication of nursing care in wards with high patient turnover, the Cardiology Department of the University Hospital of North Norway was chosen as the location for the research study.

The main diagnosis among the patients at the Cardiology Department is Coronary Artery Disease, globally the leading cause of death (www.who.int, 2009).

This study focuses on the role of the nursing documentation in the interplay of health care professionals involved in the medical procedure cardiac catheterization.

Cardiac catheterization is an invasive investigation of the heart, used to diagnose and in some cases treat Coronary Artery Disease.

There is a network of health care professionals involved in the treatment chain for cardiac catheterization and the stay in every ward is short for the patients.

In the various steps of the treatment chain: (1) scheduling of the procedure, (2) preparation of the patient, (3) performance of the investigation, (4) evaluation of the results, (5) observation after the procedure and (6) in the discharge of the patient, the documentation and exchange of medical information plays an important role.

The main aim of this study is to find what role the electronic nursing documentation plays in the cooperation and collaboration of health care professionals involved in the treatment chain of cardiac catheterization. The goal is to find out who reads the nursing documentation and where in the treatment chain.

This study is performed three years after the implementation of electronic nursing documentation. The second aim is to illuminate the long-term effects on the transition from a paper-based system to a system with the nursing documentation integrated into the EPR. The focus is on: (1) how the communication on nursing care is actually done in wards with high patient turnover; (2) how the electronic nursing documentation is used; and (3) what impacts it has on the nursing handover.

Through participating observation and interviews, the work flow and exchange of information connected to cardiac catheterization of patients was followed in three wards of the Cardiology Department.

The use of the nursing documentation in a cross-disciplinary setting is essential in this case study.

Questions asked:

How can electronic nursing documentation contribute to increased continuity of care in the Cardiology Department?

How can electronic nursing documentation contribute to improved flow and exchange of information in the Cardiology Department?

1.2 Outline of the Thesis

The thesis is organized in six sections.

Chapter one gives the context and introduction of the study.

Chapter two, the theory section, presents the national Information and Communication Technology (ICT)-strategy with a focus on electronic communication and cooperation. The jurisdiction and guidelines from authorities related to the EPR and nursing documentation in Norway are described. Further, international nursing classification systems and national guidelines related to the nursing documentation are presented.

The theoretical framework for the thesis is the notion of information infrastructure and actor-network theory. The main points from the notion of information infrastructure are used to understand the socio-technical aspects of an information system and infrastructure; the roles of the actors, the institutions and the technology involved. The notion information infrastructure is followed by the actor-network theory, which is used to map out the social and technical actors, the roles they play and their interaction.

Chapter three, the method section, describes the study design and gives an introduction to the qualitative method and interpretative research approach. The data

collection section is followed by reflections on the research method and the role as a participating observer.

Chapter four, the study of the information flow in the Cardiology Department as a case study is divided into different parts; first, a presentation of the research setting and the hospital information system; second, the implementation process of the electronic nursing documentation is described and also the impacts of electronic nursing documentation in the Cardiology Department. The role of nursing documentation in the exchange of information between health care professionals involved in cardiac catheterization is mapped out. The insights of the interviewed users of the nursing documentation, observations and a literature review are presented thoroughly in this section.

In *Chapter five*, the key points of the case are summarized and the analysis is grounded on the concepts of information infrastructure and actor-network theory. Finally in *Chapter six*, conclusions from the findings in the study of the exchange of information at the cardiology ward are drawn.

2. Theory

In this chapter, a brief overview of the organization of the Norwegian health care services and the plan for national Information and Communication Technology (ICT) is presented, followed by legislation and guidelines regarding the EPR and nursing documentation. International standards, classification systems and national guidelines regarding nursing documentation are also described in the following text. Further, the notion of Information Infrastructure is introduced and related to Hospital Information Systems, EPR and nursing documentation. The key concepts of nursing documentation are briefly presented. Moreover, there is a description of Actor Network Theory (ANT), some theoretical aspects that illuminate the actors and the interplay of this case; the roles and the technology.

2.1 National ICT and Health Care Services

In Norway, the Ministry of Health and Care Services has the overall responsibility for government policy related to health and care (www.regjeringen.no, 2009).

The Directorate of Health is placed directly under the Ministry of Health and Care Services and is a specialist director and an administrative body with responsibility for the area of public health and health care services. The main mission is to ensure that policies from the Ministry of Health and Care Services and the Ministry of Labour and Social Inclusion are implemented in the health and care area (www.helsedirektoratet.no, 2009).

The Ministry of Health and Care Services is the owner of the four Regional Health Authorities (*see figure 1*), and they are responsible for the specialized health care in their region. The municipalities are responsible for providing primary health care to their populations. The government contributes to primary health care through financing, legislation and supervision (www.regjeringen.no, 2009).

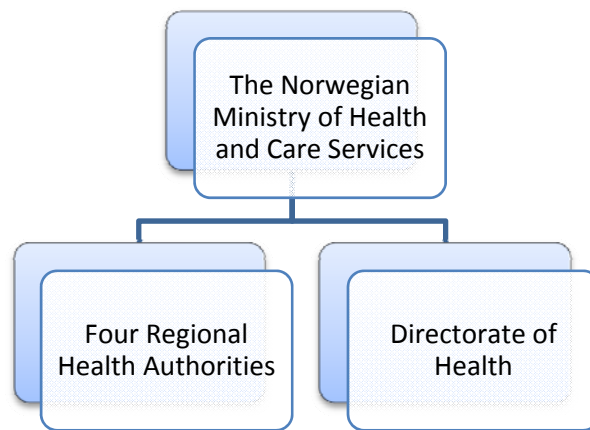


Figure 1: Organization of the Health Authorities of Norway

In the National Health Plan for Norway (2007–2010), the Ministry of Health and Care Services presents the status of the health service and proposes actions that are intended to result in increased quality of health service. The National Health Plan sets a focus on development of national ICT, electronic communication and interaction in the health services (National Health Plan, 2007-2010).

“Appropriate use of information and computing technology combined with development of the organization with a stronger focus on teamwork can contribute to achieve health-political goals, increase quality of health care services and effectiveness.” (National Health Plan, 2007-2010 p.295)

The Ministry of Health and Care Services is working on The Coordination Reform (Samhandlingsreformen), which will be presented in June 2009. The main aim is to address the lack of coordination between specialized health care and primary health care. The goal is to strengthen the coordination of health services with socio-economic benefits to the society. For the patient, the benefits will give better flow and coordination of health care services and shorter waiting time (www.regjeringen.no, 2009).

“An improved information flow between the different links in the chain of treatment can help to reduce unnecessary waiting time and delays in the sequence of patient care.” (Te@mwork, 2007 p.16)

The Ministry of Health and Care Services has published a national strategy for electronic coordination and cooperation in health care services. The newest edition, which is the fourth ICT-strategy from the government, is called Te@mwork 2.0 (Samspill 2.0) and is the plan for 2008 to 2013. The former strategic plan was named Te@mwork 2004-2007. The main purpose of the strategy documents is to improve the flow of information between the actors in the different levels of health care.

The Directorate of Health is leading the work on better coordination in health care and has published a plan called Implementation Plan 2007 for Te@mwork 2007.

“A national information structure will be an important basis for a holistic approach, setting priorities and cross-functional coordination of the efforts to achieve continuity of patient care” (Implementation Plan, 2007 p.11).

In the National Health Plan 2007-2010, development of the EPR is pointed to as the central objective for better electronic collaboration and interaction. The structure of the EPR has to adapt better to the needs of the users. Technical solutions are supposed to provide the health care professionals with updated information about the patient/user (National Health Plan, 2007-2010 p.295).

Implementation Plan 2007 points out that ICT solutions designed for health care are supposed to change work practices and generate long-term socio-economic benefits and effects. Most of the health care sector is using EPR, but the information flow is not working as expected. The systems are not utilized enough and the quality is not good enough.

“It takes time to develop good, functional solutions which will not only replace today's paper-based solutions, but will also be used in a new everyday reality with changed and more appropriate forms of work. And, not least, it takes time before all collaborative players are at the same level.”
(Implementation Plan, 2007 p.6)

Implementation Plan 2007 says further health care is an intermediate phase with one foot in the manual, paper-based world and the other in the electronic world. In hospitals, the patient records exist in paper-versions, scanned and also in electronic versions. This gives extra expenses for the hospitals and is less user-friendly for the health professionals.

The plan from the Ministry of Health and Care Services is to complete the process and let electronic teamwork contribute to a better coordination and continuity of patient care (Te@mwork, 2007).

The aim of the implementation plan for National Teamwork is to help the players at the national, regional and local levels enable the transition to a situation with full electronic support.

“The patient record forms the core of the information flow in the health service. Information from all groups of health professionals with the duty of documentation is collected here. The EPR in all links of the service chain, with information content and functions that support electronic interaction, is the prerequisite for realizing continuity of care in the health and social-services sector.” (Implementation Plan, 2007 p.17)

Further, Implementation Plan 2007 states that the EPR should provide relevant health information when needed to all the links of the treatment chain. One of the aims of the EPR is to contribute to better support of patient care and work processes.

The quality of the EPR can be improved. Some of the EPR-systems today are a continuation of the paper-based system, based on chronologic documentation.

“A comprehensive and holistic introduction of EPR which supports the clinical processes is regarded as offering the greatest potential for benefits of all the ICT initiatives in the sector.” (Implementation Plan, 2007 p.35)

Implementation Plan 2007 argues that a more problem-orientated modernized structure of the information is needed to support the exchange of information and for re-use of the medical information for registers, research and administrative purposes.

Further, Implementation Plan 2007 states that in the development of the next-generation EPR there has to be a change from a documentation tool to an artifact in supporting the continuity of patient care. User-involvement by the clinicians is important in this work.

“Successful sociotechnical design of information systems in health care starts with a thorough understanding of the practices in which they are planned to function.” (Berg & Goorman, 1999)

The National Health plan 2007-2010 also has a goal to upgrade national medical clinical registers and technical solutions for extraction of data from the EPR to medical registers.¹ The National Health plan wants to strengthen the research in the health service, and the access to medical data through medical registers will support the research in the field (National Health Plan, 2007-2010 p.295).

In the words of Berg and Goorman (1999):

“The information in EPR is not only for registration of health work, but also data gathered for secondary purposes as research.”

¹ Today there are 60 medical registers in Norway.

In the national information structure, electronic messages are seen as relevant in routine exchange of structured information. That is for instance discharge letters, referrals, prescriptions, requisitions and results from medical examinations (Implementation Plan, 2007).

Implementation Plan 2007 says all electronic communication between General Practitioners and hospitals should be through the Norwegian Health-net (Norsk Helsenett). The Norwegian Health-net is developed to contribute as a network for effective cooperation and exchange of information between the different levels of health care (Implementation Plan, 2007).

The Norwegian Center for Informatics in Health and Social Care, KITH, under the Ministry of Health and Care Services and the Ministry of Labour and Inclusion is responsible for development of standards for exchange of information in health care. KITH is working on a national collaborative architecture with requirements for standardized communication (Teamwork, 2007).

The mission statement of KITH is:

“Information Technology for improved Health and Social Care.”

KITH is responsible for the program of Standardization and Coordination (Standardiserings- og samordningsprogrammet) which is contributing to standards and guidelines in the health care services. KITH is responsible for test and endorsement of systems for the national exchange-standard for health information.

The following conditions have to be followed: (1) only standardized messages shall be in use and go through the Norwegian Health-net (*see figure 2*); new implementations to the system have to be approved by KITH; and (3) the standard ebXML has to be used. EbXML or Electronic Business Extensible Markup Language is an open standard, designed to create interoperable and secure

information systems who share information over the World Wide Web (www.ebxml.org, 2009).

The use of different standards in Norwegian health care leads to communication problems between the systems and delays the process of a well-working system for exchange of electronic communication. KITH is involved in standardization work of European CEN and other international working groups (www.kith.no, 2009).

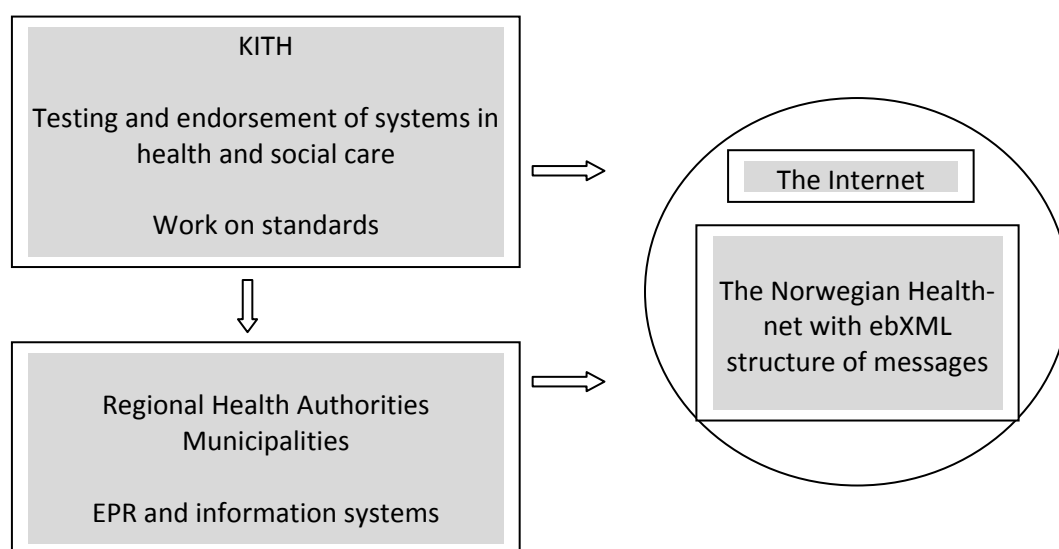


Figure 2: Flow and exchange of electronic information in health care

2.2 EPR and Nursing Documentation

One of the aims of this thesis is to analyze the role of nursing documentation in a cross-disciplinary setting in a hospital. To illuminate the function of the nursing documentation, the following texts present an overview of legislation, guidelines and traditions related to the EPR and nursing documentation, both from a national and international point of view.

Health care services are becoming more fragmented and specialized. The information technology presents an infrastructural arrangement to share information

and coordinate work through the EPR (Munkvold & Ellingsen, 2007). There is a growing intention in health care to organize the work for the individual patient case rather than after the organization of health care (Winthereik & Vikkelsø, 2005). The Norwegian government is working on the Coordination Reform, and the main aim is to coordinate services from the different actors of health care individually for each patient (www.regjeringen.no, 2009).

“Health information systems, such as electronic patient records, are seen as important change agents, since they are asserted to help the coordination of care across organizations through fast and accurate exchange of clinical data.” (Winthereik & Vikkelsø, 2005)

In hospitals, nurses are the largest occupational group and they have a long tradition of recording nursing care (Hellesø & Ruland, 2001). The nursing documentation has traditionally been handwritten in one's own paper-record until the implementation of electronic nursing documentation into the EPR. During the last years, most institutions of specialized health care have included electronic nursing documentation as a part of the EPR (KITH, 2003).

The Health Personnel Act, 2001 (Lov om helsepersonell) imposed an obligation for nurses and 26 other health professions to register medical services in a health record. The overall impose says that all medical help to patients shall be registered, primarily by the one who performed it (Health Personnel Act, 2001).

“The one, who performs medical services, shall register information in one record for every patient.” (Health Personnel Act, 2001, Chapter 8 § 39)

The Health Personnel Act says further:

“The health record can be electronic.” (Health Personnel Act, 2001, Chapter 8 § 46)

Following is the national definition of an Electronic Patient Record:

“An electronic patient record is a patient record in which information is stored electronically in a such way that it can be retrieved and used with the aid of suitable software. An electronic patient record can also contain references to paper documents, pictures and other information that is stored outside the record.” (Te@work, 2007 p.14)

The main purpose of the nursing documentation is giving the best possible quality of treatment and care with the existing resources. The care is supposed to be professional and evaluable. High quality nursing documentation is a way to achieve this. The nursing documentation should show response and professionalism and be a natural part of caring patients (NSFID, 2007).

KITH published guidelines in 2003 for electronic nursing documentation. The guidelines are supposed to provide help to health care professionals who document the performed or planned nursing in an electronic record. The nursing documentation shall be an artifact to meet the obligations from the authorities. The following points are set up as the aim of the nursing documentation:

- *take care of the safety of the patient*
- *secure quality and continuity in the nursing care*
- *being a legal document*
- *make professional response visible*
- *make nursing care and professional experience visible*
- *being a artifact for communication*
- *being an artifact for professional development*
- *giving ground for management and use of resources*
- *being the ground for research and work of development*

(KITH, 2003)

The purpose of nursing plans described by Ellingsen and Munkvold 2007:

“Nursing plans are intended to promote improved planning of the patient case, higher quality of care and better cost containment. It is assumed that a nursing plan provides for appropriate treatment and continuity of care for the patient within and across boundaries. They shall provide predictability and clear overview.”

Hellesø and Ruland (2001) argue that the aim of nursing documentation is to reflect observations, assessments, decisions and interventions. The objective of implementing electronic nursing documentation was to improve the quality and continuity of patient care. The EPR is a working tool for nurses and supplies accurate and adequate information about the patient (Hellesø & Ruland, 2001).

The nursing process (*see figure 3*), is described as the ground for nursing care and gives a structure for the collection of information and nursing documentation (NSFID, 2007).

Collection of data/nursing assessment	Identify problems, needs
Nursing diagnosis	Analysis of data writing nursing diagnosis
Planning	Goals for nursing care Prioritize problems /needs Prioritize nurse interventions
Perform nursing interventions	
Evaluation	Evaluation of goals

Figure 3: The nursing process

Dulong and Poulsen (1993) say the nursing process became a notion in health services in the 60's and has the origin in the United States. The nursing process consists of the different steps which are the foundation for the nursing documentation.

The nursing process integrated into a EPR-system should be there as a helping instrument. Guiding nursing plans or nursing classifications can be helpful in documenting the different steps of the nursing process (NSFID, 2007).

A nursing diagnosis is a standard statement about a patient or client. The statement is built on data collection based on the nursing assessment. The aim is to standardize the use of terminology related to the nursing diagnosis, interventions and outcomes/evaluation. International nursing classification systems meant to structure the nurses' data and being a tool in the clinical decision process have been developed (Hellesø & Ruland, 2001). The aim of nursing diagnosis is to focus on the patient's individual reaction on own disease and health-related problems which enables increased continuity of care. The medical diagnosis, which focuses on the disease, and nursing diagnoses are complementing each other (Axelsson et al., 2006).

Some of the international classification systems are North American Nursing Diagnosis Association (NANDA International), Nursing Intervention Classification (NIC), Nursing Outcome Classification (NOC), International Classification for Nursing Practice (ICNP) and the Swedish Nursing Classification System (VIPS). The following text provides a short description on each classification system.

NANDA International is one of the largest organizations in the field of nursing diagnosis. The purpose is to enhance every aspect of nursing through the development and use of a standardized terminology that reflects the clinical judgment of the nurses and promotes improved quality of evidence-based care (www.nanda.org, 2009).

NIC is a standardized language to describe the treatments of nurses. The aim is to provide a standard language for communication of care. NIC contains 433 numbered interventions with detailed descriptions of activities. The use of NIC in planned and documented care can be studied from a database for analysis and evaluation of the quality and effectiveness of performed care (www.ncvhs.hhs.gov, 2009).

NOC is a system for evaluation of the outcome or effect of the nursing interventions. There are 330 outcomes listed in alphabetical order and with a scale to measure the effect. When NOC is used in EPR, a code is registered which can be used for evaluation of the nurse practice (www.nursing.uiowa.edu, 2009).

ICNP owned by International Council of Nurses, is a language for documentation of nursing practice. It consists of three elements: nursing diagnosis, nursing actions and nursing outcomes. The aim is to be an international standard for description of the nursing practice, improve the communication between nurses and other health professionals (www.icn.ch, 2009).

VIPS is a Swedish documentation model which was scientifically developed and published in 1991. The purpose for the model was to support systematic documentation of nursing care with individual basis (Ehrenberg & Thorell-Ekstrand, 1996). The letters are an acronym representing four key concepts and major goals of care; well-being, integrity, prevention and security. VIPS is built on a lower degree of standardization than the other classification systems (Hellesø & Ruland, 2001). The University Hospitals of Norway have used VIPS as a system for nursing documentation (KITH, 2003).

“How can we look at the work on information structure and standardization in context with terminology, concepts, and classifications?” (Teamwork, 2007)

The Norwegian Nursing Association (NSF) has been a part of the national work in the strategy for electronic coordination and cooperation. NSF has recommended the use of standard vocabulary in the nursing documentation. In February 2009, NSF recommended that ICNP become integrated into EPR as a tool for documenting health care. NSF states that coded classifications in the EPR will strengthen the exchange of medical information. ICNP is designed to be used in EPR systems (www.sykepleierforbundet.no, 2009).

The nursing documentation has a complex role and reflects that nurses are weaving together the work in a ward. Nurses are usually the team-leader for a group and plan the work of a shift. They provide for continuity of care for the patients. The nursing documentation reflects the nurses' assessments, interventions and planning of nursing care. Well-working systems for nursing documentation will increase the quality and the security of nursing care and treatment in hospitals through better communication between nursing colleges and other health care professionals.

2.3 Information Infrastructure

The two last chapters have described the national work on ICT-standards, the structure for storage and exchange of health information with a focus on nursing documentation. In this chapter, an overview of the notion of information infrastructure is illuminated through literature and studies made in the field.

Infrastructure means everything in a society. The Compact Oxford English Dictionary (www.askoxford.com, 2009) provides the following definition of the word infrastructure:

“The basic physical and organizational structures (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise.”

Within all levels of the health care services of Norway, there is ongoing work on upgrading the information infrastructure. The government is leading the work through national guidelines. The national nursing association (NSF) is involved in the work on standardization for increased quality of the nursing documentation. The municipalities and hospitals are supposed to use electronic messages through the Norwegian Health-net instead of today's high grade of paper-communication.

“Traditional approaches to information systems development are implicitly based on assumptions where the information systems are closed, stand-alone systems used within closed organizational limits... When developing infrastructures, the focus on closed, stand-alone systems has to be replaced by one focusing on the infrastructures as open and global.” (Hanseth & Monteiro, 1998)

Hanseth and Monteiro (1998) state that establishment of an information infrastructure is highly socio-technical work that needs an understanding of the processes involved: the actors, institutions and technologies that play a role. Information infrastructures have to be seen from a holistic point of view because they consist of more than individual components.

In the development of information infrastructures there is a tension between standards and flexibility; the interplay between technological issues on one side and human, social and organizational issues on the other side (Orlikowski & Robey, 1991; Hanseth & Monteiro, 1998). Information infrastructures and development of them may be described as specification and implementation of standards. The different elements of an information infrastructure are integrated through standardized interfaces (Hanseth & Monteiro, 1998).

Bowker and Star (1999) illuminate the history of information infrastructure:

"Infrastructure does more than make work easier, faster or, more efficient; it changes the very nature of what is understood by work. The story of information infrastructure is not, in this sense, the history of great people. Much of the work has been done offstage by communities of hackers, technicians, and engineers, and in maintenance, upgrades, and integration. Creating an infrastructure is as much social, political, and economic work as it is theoretical."

Hanseth and Monteiro (1998) made a study of the characteristics of an information infrastructure with a focus on the primary characteristics of other infrastructure technologies in general and analyze how they appear in information infrastructures. They found that infrastructures are connected and inter-related constituting ecologies of socio-technical networks. The building of large infrastructures takes time and all the elements are connected. Over time, the infrastructure has to adapt to new requirements that appear.

Further, they emphasize that the whole information infrastructure cannot change instantly; the new version has to be connected to and interoperable with the old version. Infrastructures are never developed from scratch, but through extension and improvement of the existing infrastructure, also called the installed base.

Hanseth (2002) defines information infrastructure as the following:

"An information infrastructure is a shared, evolving, open, standardized, and heterogeneous installed base. A key characteristic of infrastructures is that they evolve over long time where the existing infrastructure - the installed base - strongly influences how it can be improved."

In this definition, Hanseth (2002) describes an information infrastructure as a shared resource or a network for a community, collection of users and user groups. Further, infrastructures are open, and openness in this context means lack of borders; no limit for the number of users, stakeholders, vendors, nodes and technological components

in the network or network operators. There is no limit for the number of included applications or number of computers linked to the network, and there is neither a border in participating and contributing to the design and deployment. The development of an information infrastructure has no beginning or ending, the development time is open and on-going (Hanseth, 2002).

The unlimited number of users, components and use areas with a wide range of activities at the same time implies heterogeneity. Infrastructures are not tailored to one particular activity, they are more than pure technology; they are rather socio-technical networks (Hanseth & Monteiro, 1998).

An information infrastructure is standardized and heterogeneous at the same time. It includes both technological components as well as non-technological, which can be human, social or organizational components. For a hospital information system, the technical equipment, the software, the network and the users form the information infrastructure.

Finally, Hanseth (2002) argues that the fact of infrastructures being open and evolving over a long time has implications for what kind of strategy will manage to control the system. The system is open and in use all the time and is serving a large community. Each new feature or version has to fit /operate with the existing infrastructure or installed base working at that moment.

A hospital information system represents a huge information infrastructure. With all health professions as users, the system represents the main artifact for administrative work, registration of medical information and is supporting the coordination of work. Coiera (2004) stresses that systems are not only technical systems, but they are also socio-technical systems. In designing systems, there is a need to understand how people work.

Nurses are the largest occupational group in hospitals and when the nursing documentation was implemented in the EPR, the hospital information system obtained numerous new users. Nurses have traditionally used parts of the hospital information system in the requisition of blood-samples and finding results from blood-samples and X-ray. With the nursing documentation integrated into the EPR, the hospital information system stands for a holistic system with equal access to medical information where the aim is to support increased continuity of care and work processes.

2.4 Actor-Network Theory

Considering information infrastructures as heterogeneous socio-technical networks, consisting of technological and non-technological components, the actor-network theory can help in mapping out the role of the actors involved and the interplay of the actors in the network. In health care services, the actors are presented in different levels and the main sectioning is primary health care and specialized health care. Physicians, nurses, enrolled nurses, secretaries, non-medical staff; the list is long on involved actors. The technology consisting of networks, software and computers is playing an even more important role than ever in communicating secure health information. In the maintenance of a hospital information system, key-roles are played by engineers, IT-consultants and functions like help desk. All the actors are connected together in a network with the main aim to provide continuity of care when performing health care services (National Health Plan, 2007-2010).

Health care service represents complex organizations where change and development of routines takes time. Actor-network theory can provide better understanding of the technological and social aspects when implementing and upgrading systems for exchange of information in the large and complex organization of health care service.

Actor-network authors started out in the sociology of science and technology. Actor-network theory has a focus on how science actually is done, not how it is supposed

to be. It is a strategy to un-pack the complexity of the environment around us (Monteiro, 2000).

The argument is that knowledge is a social product rather than something generated by a scientific method and may be seen as a product or an effect of network of heterogeneous materials. Law (1992), one of the early actor-network authors stated the following:

“If human beings form a social network it is not because they interact with other human beings. It is because they interact with human beings and endless other materials too.”

Law (1992) argues that actor-network theory defines science as a process of heterogeneous engineering where elements from the social and technical field are connected and translated into a heterogeneous scientific result. Actor-network theory is relational and process-oriented sociology that treats the elements as interactive effects. This is the core of the actor-network approach; the concern for how actors and organizations mobilize and hold together the elements of which they are composed.

According to Law (1992), the analysis of ordering struggle is central to actor-network theory. The object is to explore and describe local and social processes of patterning of an organization.

“The actor-network approach is thus a theory of agency, a theory of knowledge, and a theory of machines. It says that we should be exploring social effects, whatever their material form, if we want to answer the “how” questions about structure, power and organization.” (Law, 1992)

Actor-network theory sees social structure as a verb, not a noun. Actor-network theory defines a set of questions for exploring the complex mechanisms of an

organization. When actor-network theory explores the character of an organization, it maps out the effect of interaction between materials and strategies of organization. There would not be a society at all if it were not for the heterogeneity of the networks of the social. The task of sociology is to characterize these networks in their heterogeneity and explore how they became patterned to generate effects like organizations, inequality and power (Law, 1992).

“The argument is that these various networks participate in the social. They shape it.” (Law, 1992)

Monteiro (2000) argues that all factors are related or connected to how you act and an actor-network is the act linked together with all of its influencing factors, producing a network. An actor-network consists of and links together both technical and non-technical elements.

“An actor-network is literally the network of heterogeneous materials that make up the context... The notion of an actor-network, quite literally, instructs us to map out the set of elements (“the network”) which influence, shape or determine action.” (Monteiro, 2000)

Actor-network theory says that order is generated by heterogeneous means. An actor is a patterned network of heterogeneous relations, or an effect produced by a network. In the actor-network terms an actor is also always a network and these participate in the social. The same is true for organizations and institutions: they have roles played by people, machines, texts, buildings, all kind of materials (Law, 1992).

Monteiro (2000) describes two concepts from actor-network theory that are of particular relevance: *inscription* and *translation* and they are illuminated further in the following text:

Inscription refers to how technical artifacts or object shall be used from the surrounding actors, a program of action. An inscription is used to describe the vision in the development and use of new technology.

Translation is a social process of aligning interests, mapping out the needs of the “users”. The process of translation can be seen as a model for problem-solving. Callon (1986), one of the central actor-network authors, has published the following description of the four moments of translation:

“1. Problematization: the researchers sought to become indispensable to other actors in the drama by defining the nature and the problems of the latter and then suggesting that these would be resolved if the actors negotiated the obligatory passage point’ of the researchers’ programme of investigation.

2. Interessement: a series of processes by which the researchers sought to lock the other actors into the roles that had been proposed for them in that programme.

3. Enrolment: a set of strategies in which the researchers sought to define and interrelate the various roles they had allocated to others

4. Mobilisation: a set of methods used by the researchers to ensure that supposed spokesmen for various relevant collectivities were properly able to represent those collectivities and not betrayed by the latter.” (Callon, 1986)

Monteiro (2000) argues that needs are translated into a solution, for instance a system. When designing (or translating) the system, the designer works out a scenario (or plan) for how the system will be used. This scenario is inscribed into the system. The inscription means a program of action for the users and also defines roles played by the users and the system. When making an inscription, assumptions

are made about what competence or skills are required by the users and the system. The technology also becomes an actor when imposing the inscribed program of action on the users. Inscriptions have a varying flexibility, some have a strong structure, others a weak one.

“The strength of inscriptions, whether they must be followed or can be avoided, depends on the irreversibility of the actor-network they are inscribed into.” (Monteiro, 2000)

When a system is implemented, the users will translate the system into the context of the work tasks; this means that the actual use can deviate from the plan or the inscription. In the words of Gasser (1986):

“...a way to work around ordinary routines, to make another system or way to manage work efficient and cooperative.”

Monteiro (2000) describes information infrastructure as an aligned network. When developing the socio-technical process of an information infrastructure, the actor-network theory contributes with vocabulary to describe the information infrastructure.

“Actor-network theory provides a language to describe how, where and to which extent technology influences human behavior... Actor-network theory provides a platform to zoom in and zoom out the perspective on information infrastructure.” (Monteiro, 2000)

Related to health care services and information infrastructure, one can consider how actors as work routines, legal documents, procedures and guidelines attempt to inscribe patterns of use. When inscribing patterns of use, the flexibility of an information infrastructure is confined. As mentioned by Hanseth and Monteiro (1998), when developing an information infrastructure a tension between standards

and flexibility occurs; the interplay between technological issues on one side and human, social and organizational issues on the other side.

In *Chapter 5*, the discussion part, actor-network theory and information infrastructure will be connected closer to the case and form the ground for further analysis of the actors and the roles.

3. Methodology

This chapter focuses on how the study of the nursing documentation was performed. First of all, there is a presentation of the research design, an overview of qualitative method, and the interpretative research approach. Secondly, the data collection of empirical material is described in section 3.2. Moreover, reflections on the methodology, the role as an observer during the field work, and the interaction with the informants are discussed in section 3.3.

3.1 Research design

3.1.1 Qualitative research method

To obtain an in-depth understanding of the use of technology in a complex organizational setting, qualitative research methodology was chosen. The following text describes quantitative and qualitative research methods, makes a comparison of the methods and reflects on complementary use of the methods.

Quantitative health sciences researchers often work from the assumption that “there is an absolute truth”, with a definition that knowledge is objective and neutral (Kuper et al., 2008). Quantitative research method is appropriate when understanding the size, the extent, and the duration of a phenomenon where the answers can be found through using a measuring technique such as questionnaires. In medical research, a quantitative research approach with Randomized Controlled Trials (RCT), meta-analysis and cohort-studies have been most common (Stoop & Berg, 2003).

Quantitative research, with the belief on an absolute truth is called objectivism based on the theoretical framework of positivism. This can be a challenge when studying social phenomena and behavior. Qualitative researchers support the belief about knowledge, called constructivism; meaning that our reality is constructed through how we interpret the social, historical, and individual context obtained through

perception. Results from qualitative research are typically reported in words and quantitative results primarily in numbers (Kuper et al., 2008; Stiles, 1999). Understanding the context in which people live and their different perspectives is the central issue of qualitative studies. This often takes form as case studies, with a rich array of descriptions (Stiles, 1999).

The aim of qualitative research is to achieve in-depth accounts from individuals and groups. The method of sampling data is talking to and watching individuals / groups in the context of the study.

“Qualitative researchers primarily gather data from interviews (semistructured or unstructured), focus groups, observations, or documents and other written artifacts.” (Kuper et al., 2008)

Qualitative methods are a covering term for a heterogeneous group of methodologies with different theoretical origin and a different view about knowledge. The goal of qualitative research is to understand social phenomena in the natural context; it is an exploration of real life and the participants can pass on their view and meanings (Kuper et al., 2008; Pope & Mays, 1995).

“Qualitative methods are becoming increasingly prevalent in medical and related research. They provide additional ways for health researchers to explore and explain the contexts in which they and their patients function, enabling a more comprehensive understanding of many aspects of the healthcare system.” (Kuper et al., 2008)

Qualitative and quantitative methods represent two different approaches of research. They are often compared to each other in validation of research results, and are frequently presented as adversaries in the methodological battle (Pope & Mays, 1995).

“In general, quantitative research focuses on answering the questions “what?”, “how much?”, and “why?”, whereas qualitative research focuses on answering the questions “why?” and “how?”.” (Kuper et al., 2008)

Health care services deal with people, in a complex context. In analyzing the questions about patients’ interaction with health care professionals and interpretation of the interaction, quantitative methods are less well suited in finding answers. Qualitative research is useful in understanding why patients behave as they do (Pope & Mays, 1995).

Pope and Mays (1995) made a study on how qualitative study can contribute to enrich the knowledge of complexity of modern health care and how the two methods can be considered complementary instead of adversarial. First, qualitative work can be conducted preliminary to quantitative research to provide an understanding of the situation or behavior. Second is to supplement quantitative work as a part of the validation process; e.g. triangulation, where three or more methods are used and the results are compared.

The third way where qualitative research can complement quantitative work is by exploring complex phenomena or areas not suitable to quantitative research. This kind of research is used in studies of health service organization and policy and might be useful in investigating the health care services in times of changes and reforms to find the point of view from patients, health care professionals and the organization.

“... qualitative work can reach aspects of complex behaviors, attitudes, and interactions which quantitative methods cannot.” (Pope & Mays, 1995)

Stoop and Berg (2003) argue that the use of multi-methods research can strengthen and enrich research results when the data from one method is used as input to another method to achieve a result with strong validity.

3.1.2 Interpretative research approach

The reasons for performing this case study were to gain understanding of the complexity and the interaction of the actors and technology involved in the treatment chain of cardiac catheterization; and to find what role the nursing documentation plays in this process. An interpretative research approach inspired by ethnology with participant field observation supplied by interviews was chosen to be a part of the social interplay and to observe the work flow. In the words of Harper (2000):

“Ethnography is simply one way of looking at how people do their work.”

The thesis is inspired from studies in health care services with similar approaches, (Berg & Goodman, 1999; Ellingsen & Munkvold, 2007; Munkvold et al., 2006; Winthereik & Vikkelsø, 2005).

Qualitative researchers base their research process and presentation of the findings on theories drawn from social sciences (Reeves et al., 2008a).

“Theories provide complex and comprehensive conceptual understandings of things that cannot be pinned down: how societies work, how organizations operate, why people interact in certain ways. Theories give researchers different “lenses” through which to look at complicated problems and social issues, focusing their attention on different aspects of the data and providing a framework within which to conduct their analysis.” (Reeves et al., 2008a)

Reeves et al. (2008a) say further that theories are used as help in designing a research question and they work as a guide in the selection of relevant data. Theories are used for interpretation of research data and propose explanations of observed phenomena or context.

Qualitative research has traditionally been divided into an interpretative approach and a positivist approach. A positivist approach is associated with a natural science model of social science research. An interpretative approach is a way to study social reality and is associated with ethnography, hermeneutics, phenomenology and case studies. A social scientist must interpret the empirical reality in terms of the observed people (Lee, 1991). Interpretative research has become common in information system research (Walsham, 1995).

“Interpretative research can help information systems researchers to understand human thought and action in social and organizational contexts; it has the potential to produce deep insights into information systems phenomena including the management of information systems and information systems development.” (Klein & Myers, 1999)

According to Klein and Myers (1999), interpretative research focuses on the complexity of human sense and tries to understand phenomena through the meanings assigned by people. The aim of using an interpretative method in information systems research is to understand the interaction where information systems influence and are influenced, by the context.

Reeves et al. (2008b) describe the aim of ethnography as exploring the nature of social phenomena. This provides holistic insights of people’s views and actions through a collection of detailed observations and interview.

Reeves et al. (2008b) describe ethnography as:

“The study of social interactions, behaviors, and perceptions that occur within groups, teams, organisations, and communities. Its roots can be traced back to anthropological studies of small, rural (and often remote) societies that were undertaken in the early 1900s.”

Observational study, making field notes of the situation observed, represents the main method of data collection in the field of ethnography (Tjora, 2006). Junker (1960) defines observation as collecting information in society and field-notes as writing an account of the observations. Miller and Dingwall (1997) describe observation as the most fundamental discipline for the sociologist; listening to what is said by following the social environment.

In Miller and Dingwall's (1997) own words:

“... observers also select from the universe of sensations to which they are exposed in any given setting and may exercise some impact on that setting. ... Nevertheless, the fundamental virtue of observation... is that it enables us to document members accounting to each other in natural settings. ... we come closer to understanding the production of everyday life in a much wider range of environment. Observation is a document of the transactions between members themselves. Observation tells us about the set of solutions that have been produced, how people solidify and stabilize their social environment and how, on occasion, they play with it and test it.”

Tjora (2006) states that interviews and observations are interactive:

“The interview provides leads for the researcher's observations, while observations suggest probes for interviews.”

The interviews of this study were performed to gain insight from the informants on the implementation process of the electronic nursing documentation, to find expectations and evaluate the process. The interviews were also used to map out the users of electronic nursing documentation, to find interactions between the professions and to find out what role the information in the electronic nursing documentation plays in the cross-disciplinary setting.

“A key feature of the framing of interviews is that the interviewer defines what the parties are going to talk about and what will count as relevant. The interview is a turn-taking system that requires that the interviewer proposes topic and that the respondent seeks to produce locally acceptable answers. ... an interview is not a conversation...it is a created opportunity to talk about something that the interviewer is interested in and that may or may not be of interest to the respondent. Where interviewers construct data, observers find it.” (Miller & Dingwall, 1997)

The use of participant observations and interviews is an interactive process. Through observations a lot of questions will occur, that can be illuminated in an interview at a later stage in the study. At the same time, interesting points are mentioned in interviews that are studied further in the observations.

3.1.3 Validation and evaluation of interpretative research

In qualitative research, there has been a concern about how to assess quality and how to judge qualitative work. Mays and Pope (2000) outline two views on how qualitative methods might be judged, and argue for assessment according to two broad criteria: validity and relevance. Mays and Pope (2000) point out the following when doing an assessment:

- *“Worth or relevance—Was this piece of work worth doing at all? Has it contributed usefully to knowledge?”*
- *Clarity of research question—If not at the outset of the study, by the end of the research process was the research question clear? Was the researcher able to set aside his or her research preconceptions?*

- *Appropriateness of the design to the question—Would a different method have been more appropriate? For example, if a causal hypothesis was being tested, was a qualitative approach really appropriate?*
- *Context—Is the context or setting adequately described so that the reader could relate the findings to other settings?*
- *Sampling—Did the sample include the full range of possible cases or settings so that conceptual rather than statistical generalizations could be made (that is, more than convenience sampling)? If appropriate, were efforts made to obtain data that might contradict or modify the analysis by extending the sample (for example, to a different type of area)?*
- *Data collection and analysis—Were the data collection and analysis procedures systematic? Was an "audit trail" provided such that someone else could repeat each stage, including the analysis? How well did the analysis succeed in incorporating all the observations? To what extent did the analysis develop concepts and categories capable of explaining key processes or respondents' accounts or observations? Was it possible to follow the iteration between data and the explanations for the data (theory)? Did the researcher search for disconfirming cases?*
- *Reflexivity of the account—Did the researcher self consciously assess the likely impact of the methods used on the data obtained? Were sufficient data included in the reports of the study to provide sufficient evidence for readers to assess whether analytical criteria had been met?“(Mays & Pope, 2000)*

Interpretative research tradition has been criticized by researchers for the lack of focus on validation. In this regard, Klein and Myers (1999) have set some principles derived from anthropology, phenomenology and hermeneutics for conducting and

evaluating an interpretative field study. The seven principles are based on the hermeneutic circle, the fundament of all hermeneutic work. The first principle is *The Fundamental Principle of the Hermeneutic Circle*, which suggests that to achieve understanding of the complex whole, there has to be an iteration of the meaning of the parts and the interrelationships passing back to the whole. After a number of iterations in the circle, a complex whole of shared meanings appear.

The second principle, *Principle of Contextualization*, requires reflections on the social and historical background of the research setting. Interpretivists mean organizations, the actors and the technology, are in constant change, the result of field work has to be influenced by the history of the organization; the tension between past and present.

The third *Principle of Interaction Between the Researcher(s) and the Subjects*, suggests that research data are constructed in social interaction between researcher and the participants.

The fourth *Principle of Abstraction and Generalization*, means that theoretical abstractions and general concepts have to be related to details from interpretation of results. This is to illuminate how the researcher came to the theoretical insights in describing human understanding and social action.

The fifth *Principle of Dialogical Reasoning* refers to sensitivity to possible contradictions between the theoretical preconceptions for the research and actual findings. This means the researcher reflects on their own prior knowledge and the basis of the research design, the lens through which research data is constructed.

The sixth *Principle of Multiple Interpretations* means that the social context consists of multiple agents and applies to possible differences in interpretations among the participants. The researcher should examine influences from the social context by seeking multiple viewpoints and finding reasons for them.

The seventh and last *Principle of Suspicion* requires attention to possible biases and false preconceptions in the narratives collected from the participants. The researcher has to recognize the social world, lying behind the words of the participants. The social world means power structures, and interests and resources of the actors who construct the social world.

The intention of the principles from Klein and Myers (1999) is to improve the quality of interpretative research. Golden-Biddle and Locke (1993) reflect on validation of interpretative research:

“Authenticity means being genuine to the field experience as a result of having “been there”. ... The text conveys that the researchers grasped and understood the members’ world as much as possible according to the members’ constructions of it. To be genuine to the members’ views is a difficult task because it requires that the researchers not only learn about the members and their world, but also allow their personal and intellectual perspectives to be challenged by the field experience.”

The principles presented by Mays & Pope, 2000; Klein & Myers, 1999; and Golden-Biddle & Locke, 1993, for performing and evaluating interpretative studies are discussed further in the reflections on the methodology.

3.2 Data Collection

3.2.1 Research setting

The empirical material was collected in the period from September 2008 to February 2009 at the Cardiology Department of the University Hospital of North Norway. The primary research approach was participant observation followed by semi-structured interviews.

The Cardiology Department is organized into four wards; the organization is further described in *chapter 4*. Three of the cardiology wards were selected for the study and the main aim was to investigate the use of nursing documentation in the process of cardiac catheterization. My purpose was to find what role the nursing documentation plays in the interplay of health care professionals in the different wards and what long-term impacts the implementation of the electronic nursing documentation has for integrated care. The coordination and collaboration between health care professionals and the wards were followed in the study.

3.2.2 Participant Observation

During the data collection, I visited the Cardiology Department 16 times and participant observations were made for a total of 50 hours, and 12 semi-structured interviews were performed. The main part of the observations took place in the Cardiology Investigation Ward (*see figure 4*), where patients are prepared before and observed after cardiac catheterization.



Figure 4: Entrance of the Cardiology Investigation Ward

During the participant observations, the work flow and exchange of information regarding cardiac catheterization was studied mainly by studying how the nurses use the nursing documentation, the EPR and the management of nursing handovers.

I spent some of the hours in the Cardiology Laboratory, where cardiac catheterization is performed. The work flow, the use of the EPR, and nursing documentation were followed during the medical procedure of cardiac catheterization.

The Cardiology Ward was also visited and the main focus of the participant observation was studying the nursing handovers and the close cooperation and interaction with the Cardiology Investigation Ward.

The observations took place during the day-shift in the wards. In the beginning, participant observation was used to obtain an overview of the organization, the different roles of the health care professionals, and the treatment chain related to cardiac catheterization. During the observation sessions, I sometimes followed the work of one nurse. Other times, I was sitting in the staff room following the work flow and taking field-notes on the activities. During the observations, the informants and approximately 20 other employees with different professions have contributed by “informal talking” in the staff room. In the staff room the nurses and enrolled nurses were positive to the study, and when I asked they always let me “look over their shoulder” when working on nursing documentation in the computer (*see figure 5*). At the end of the day-shifts, I followed the nursing handover.

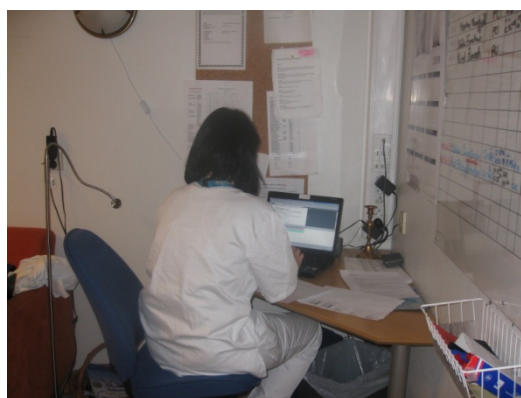


Figure 5: Working station for “looking over the shoulder”

During the observations, I always carried a note-book and made handwritten field-notes in Norwegian continuously, both when sitting besides working nurses and also when following the work-flow. The field-notes were transcribed later the same day. Much of the background information is gathered in that way and later translated into English.

The Head Nurse gave me access to read, and make an analysis of the electronic nursing documentation. This was very valuable and gave a good understanding and overview of how the nurses use the nursing documentation. The Head Nurse allowed me to use anonymous documentation and screen shots from the nursing documentation which illuminate the findings presented in *chapter 4*.

Analyzing the nursing documentation gave insights on which parts of the nursing documentation are used frequently and how they are used. Nurses have traditionally documented nursing partially in free text. In the electronic nursing documentation, there are 12 keywords in every new opened document. The use of the 12 keywords contra free text was one of the issues to analyze.

During the observations, I always carried a digital voice-recorder and a digital camera in case interesting moments would occur. Photos are presented in order to illuminate the context and research setting.

3.2.3 Interviews

In total, 12 semi-structured interviews were conducted with nurses and physicians. The interviews were performed in Norwegian and had an average time of 45 minutes. I informed about the aim of the study and confidentiality. The informants were asked for consent to use a voice recorder and that was accepted from each and all. The interviews were conducted in an office when available, other times in the staff room.

Based on observations in the primary phase, an interview guide was worked out with topics related to electronic nursing documentation. The content of the interview guide revolve around the following themes:

1. *The implementation-process of electronic nursing documentation in 2005*

How was the implementation prepared? What was the education of the employees? What were the expectations, and how is the implementation evaluated by the users? Is it possible to evaluate the use of paper documentation versus electronic nursing documentation? How is the access to computers, access to the EPR, and nursing documentation?

2. *The use of nursing documentation and the role it plays in an interdisciplinary setting*

How are the different parts of the nursing documentation used? What is the frequency of use? How is the usefulness of the electronic application? How is the use of the 12 keywords contra free text? How is the use of a nursing plan working? What role does the nursing documentation play in the nursing handovers and for other professions also involved in cardiac catheterization? Who reads the nursing documentation and why? What long-term impact does the implementation have routines in the ward and between wards after the process?

Three interviews were made during the first week to gather background information about management of the wards and the implementation-process of electronic nursing documentation. The respondents of these interviews have long experience. They played important roles in the implementation-process of electronic nursing documentation, and could contribute with useful background information. Two interviews were performed with employees at the Cardiology Laboratory. Five

interviews with nurses were performed at the Cardiology Investigation Ward. One of them is working at the Cardiology Investigation Ward permanently and four are in a rotation system and are also working at the Cardiology Ward. Two physicians in the Cardiology Department were interviewed.

The selection of the informants included registered nurses, specialized nurses, physicians and the project manager for the implementation of electronic nursing documentation. Two informants can be considered as key-informants. They were formally interviewed once, but contacted several times with questions and informal interviews took place.

During some interviews, the informant demonstrated elements of the electronic application for nursing documentation to illuminate functionalities or problems. The interviews were sometimes interrupted by phone-calls, beepers or messages from colleagues. The fact that unforeseen circumstances and partially high workload occurs in health care services interrupted or postponed some interviews.

The interviews were transcribed word by word in Norwegian in the following days after. The transcriptions represent hours of work for each interview. For some interviews, background noise in the staff room created difficulties with transcriptions, but the fact that short notes were written during the interviews compensated for this problem. The transcripts were read several times and interesting parts were highlighted and translated word by word into English. The translations were done as well as possible, supported by dictionaries.

3.2.3 Literature study

In the outlining of the study and preparation of the writing process, literature study assisted with insights related to the study. As Miller and Dingwall (1997) state:

“There are only two basic methods of social research. One is called “asking questions” and the other is called “hanging out”. Sociologists might want to add a third method; reading the papers.”

In the literature search, the internet sites of the University Library in Tromsø, helsebiblioteket.no and google.com represent the main search engines. Search phrases included nursing documentation, nursing handovers, qualitative method and interpretative approach. The internet sites of the Norwegian government, the Directorate of Health and the Norwegian Nursing Association contributed with a lot of important information. Syllabi from the Master of Science in Telemedicine and E-health program on nursing documentation, implementation and qualitative research (Berg & Goorman, 1999; Ellingsen & Munkvold 2007; Klein & Myers 1999; Munkvold & Ellingsen 2007; Munkvold et al., 2006; Obstfelder et al., 2007) inspired me and provided the groundwork for how to outline this study.

3.3 Reflections on methodology

3.3.1 The role of the researcher

There were several reasons for choosing the Cardiology Department for this study. The main aim was to find a ward with short-time stay for the patients and to analyze what role the nursing documentation plays for inter-disciplinary work in such a ward.

Another reason for choosing the Cardiology Department is the fact that during my 11-year employment as a registered nurse at the University Hospital of North Norway, my main working experience is related to cardiology. When conducting this study, however, I was a full-time Master-student at the University of Tromsø and had no employment at the University Hospital of North Norway.

For three and a half years, 1997-2000, I was employed at the Cardiology Department and have experience in the treatment chain related to cardiac

catheterization. In the period 2000-2007 I worked at the Medical Outpatient Ward where one of the primary tasks was to participate during stress-ECG which can be considered as the first step of cardiology investigation. With a positive stress-ECG, the patients are usually referred for cardiac catheterization at the Cardiology Department.

With this work experience, I am familiar with the cardiology procedures, work-flow, and employees at the Cardiology Department. During the participant observations, I recognized that very early I obtained an overview of routines related to nursing documentation and cardiac catheterization.

3.3.2 Access to the field

The former employment at the University Hospital of North Norway might have made the access to the field easier as some of the staff at the Cardiology Department are former colleagues. In the beginning of 2008, I sent an e-mail to the Head Nurse of the Cardiology Department with an inquiry of making a qualitative study at the ward with focus on the nursing documentation. The immediate response was positive and we arranged a meeting where the method and data collection were discussed. I was allowed to be a participant observer in the wards and conduct interviews. Based on the professional secrecy, I was allowed to study the nursing documentation. The Head Nurse informed the staff of the wards about the study. When I entered the ward as an observer in the beginning of September 2008, it was clear the employees were aware I was coming to conduct a study on nursing documentation.

3.3.3 "The computer lady"

During the first week of the participant observations, I was dressed in private clothes and used a plate with my name and the title Master-student. The reason for this was to avoid being taken as a member of the staff, dressed in white suits. Even though I was dressed in private clothes, I was contacted by patients/visitors in the corridor

with practical questions. After the first week, I used a white coat all the time and it was an advantage to be taken as an insider. I could walk in and out of the clinical setting without questions.

The fact that I am a nurse with experience from cardiology might have been an advantage in the interaction with the informants. I could easily take part in discussions and understood what they were talking about using medical expressions.

One interesting episode was when one of the informants had forgotten my name and described me as “the computer lady”. Several times the informants came with statements like this:

“You probably know much more about the functions of the nursing documentation in DIPS than I do.”

I had the impression the informants thought I was a specialist on DIPS ². In my practice as a nurse, all nursing documentation was hand-written until 2005. From 2005, I have used DIPS, but not the nursing documentation. I am not a specialist on DIPS, but since I have used the system I know a lot about the functionality.

Having my nursing education from Sweden, I am familiar with the nursing classifications of VIPS, and that was valuable when discussing nursing classifications and the use of a treatment plan with the informants.

“An interview is a point at which order is deliberately put under stress. It is a situation in which respondents are required to demonstrate their competence in the role in which the interview casts them.” (Miller & Dingwall, 1997)

² The EPR-system at the University Hospital of North Norway, further described in chapter four.

To reflect on the previous statement on interviews I used to be a colleague with two of the interviewed informants. All the interviews had the focus on the interview guide, but some interviews can be characterized as informal talking, since the informants talked about the topics without being asked questions, and there was a relaxed atmosphere. Other interviews were formally structured with questions.

Did my presence in observing the work affect the nursing documentation in the wards? The question is difficult to answer, however, when taking the role as an observer, I visited the ward with “an open mind” and tried not to influence the nurses’ work.

3.3.4 Reflections on validation of the study

The following text presents reflections regarding assessment and validation of the study. The reflections start with the seven elements of Mays and Pope (2000), followed by Klein and Myers’ (1999) seven principles for evaluation, and finally Golden-Biddle and Locke’s (1993) reflections on authenticity from the field.

Worth or relevance- this study found that the information from the nursing documentation also is shared with other healthcare professions. The old statement “*nobody reads the nursing documentation, not even the nurses themselves*” seems not to be valid in a ward with high patient turnover.

Clarity of research question - the research questions guided the research all the way through the study. Originally, the study was supposed to focus on the nurses’ work and documentation, but after a few days of observations it became clear that also other professions in the ward could contribute with knowledge and experience. Instead of focusing on the nursing profession, the focus moved to cross-disciplinary work, and what impacts the electronic nursing documentation has for cross-disciplinary work and work processes.

Appropriateness of the design to the question – a quantitative research approach could have contributed with a supplementary amount of data. However, in this study, a quantitative research approach would have required follow up interviews or observations in order to describe the findings. To illuminate the research questions, a qualitative interpretative approach was found to be relevant.

Context - the context is thoroughly described in *chapter 4*, as background for the study. Also the observations contributed to descriptions of the context.

Sampling – the wards that are involved with cardiac catheterization were included in the study. Of course a larger number of interviewees could have contributed with more data. But the data collection performed covers all the wards included.

Data collection and analysis – the interviews were performed systematically. The theory chapter provides the groundwork for the analysis of the discussion chapter.

Reflexivity of the account – the methods used on the obtained data. In the interpretative research approach, inspired by ethnology, the researcher has an interaction with the informants. Of course, the presence of the researcher can affect the informants, like in action research. In this case, the informants might have been affected in the way the nursing documentation was used when the researcher was observing.

To reflect on the seven principles of Klein and Myers (1999) for validation of field research, this study was an iterative process. The second *Principle of Contextualization* says the research field is in constant change. I followed the context through analyzing a large organizational change; when nursing documentation became electronic and the impacts from that three years later. The participant observations made me come back many times, and that supplied a lot of information on the context, both from the past and present. In the middle of the participant observations, there was an organizational change; then the Cardiology

Investigation Ward was closed during the night-shift. The consequence was transferring patients to another ward before the night-shift. This had a consequence for the nursing documentation; it became even more important to make detailed documentation of the evening shift.

The possibility to come back for discussing and illuminating issues several times, as an iterative process was absolutely present. The first *Fundamental Principle of the Hermeneutic Circle*, which suggests that to achieve understanding of the complex whole, there has to be an iteration of the meaning of the parts and the interrelationships passing back to the whole. After a number of iterations in the circle, a complex whole of shared meanings appear. The results of the study were discussed with one of the key informants, in order to have opinions whether I had managed to catch the reality.

Further, their third *Principle of Interaction Between the Researcher and the Subjects*, stresses that a critical reflection is required on how the research materials were socially constructed through the interaction between the researchers and participants. The fact that I have the background as a nurse and from the field of cardiology was probably an advantage in becoming an insider and achieving an understanding of the field. When discussing nursing documentation with the nurses, it was an advantage they knew I was a nurse and that I understood what they were talking about when using medical expressions and talking about the elements of the nursing documentation.

To follow the fourth *Principle of Abstraction and Generalization*, the notion on information infrastructure and actor-network theory was related to the interpretation of the case results.

The fifth *Principle of Dialogical Reasoning* refers to possible contradictions between theoretical preconceptions for the research and actual findings. My own knowledge on nursing made me open-minded and aware of the preconditions in the

meetings with informants. In the interaction with the informants, I tried to be neutral to the topics discussed. The research design is inspired by ethnology, simply to find a way to describe the reality from the field. In this case how the nursing documentation of a nurse interacts with other nurses and professions in order to share knowledge and information.

Following the sixth *Principle of Multiple Interpretations*, meaning the social context consists of multiple agents with different interpretations, informants with different professions and length of seniority were chosen in order to include possible multiple points of view on the role of the nursing documentation, and what long-term impacts the implementation presents for the context.

The seventh *Principle of Suspicion* recognizes the social world of the participants; power structures, interests and resources of the participants. Answers from a participant in a leading position, and a subordinate employee, might give different points of view, when asking the same question.

Finally, some words on Golden-Biddle and Locke's (1993) reflections on authenticity related to the field experience. The participant observations supply a genuine background for the study. In *chapter four*, in the section presenting background of the research setting, the observations are presented thoroughly to describe the field. The intention is to present the result as "*having been there*". The aim of the interviews was to achieve an understanding of the world as the informants see it. Hopefully I have managed to present it as "*the members' construction of the world*".

4. The Case

This chapter presents the results of the field study.

First, there is an introduction to the research setting; the organization of the University Hospital of North Norway and the Cardiology Department. Further, the hospital information system, the implementation-process and use of the electronic nursing documentation are presented. The work flow and the actors involved in cardiac catheterization are described, supplied with pictures and screen shots. The aim is to illuminate the use of EPR and nursing documentation during the process of cardiac catheterization.

4.1 Research Setting

The research was conducted at the Cardiology Department of the University Hospital of North Norway (UNN) in Tromsø (*see figure 6*).



Figure 6: University Hospital in North Norway, Tromsø

(www.itromso.no, 2009)

UNN is owned by the Northern Regional Health Authority (Helse Nord-HF). The Northern Regional Health Authority owns five health trusts in the area and is responsible for the specialized health care in the public hospitals. The Northern

Regional Health Authority is owned by the Norwegian Ministry of Health and Care Services (*see figure 7*).

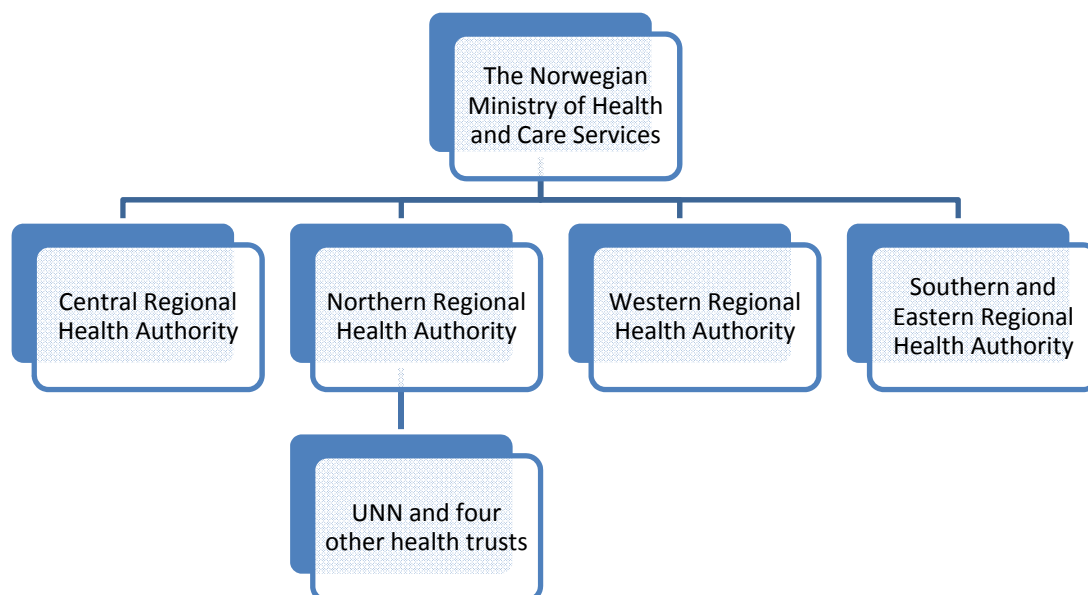


Figure 7: Organization of the Northern Regional Health Authority

The Northern Regional Health Authority is the smallest one in Norway and covers the counties of Finnmark, Troms and Nordland, a population of 465.000.

UNN has approximately 6,000 employees and consists of the four somatic hospitals of Tromsø, Harstad, Narvik, Longyearbyen and the psychiatric hospital Åsgård. UNN in Tromsø is a University clinic, the other are local hospitals. UNN is organized into ten divisions (klinikker) covering all the hospitals.

The Cardiology Department is organized into the Division of Cardiothoracic and Respiratory Medicine (*see figure 8*).

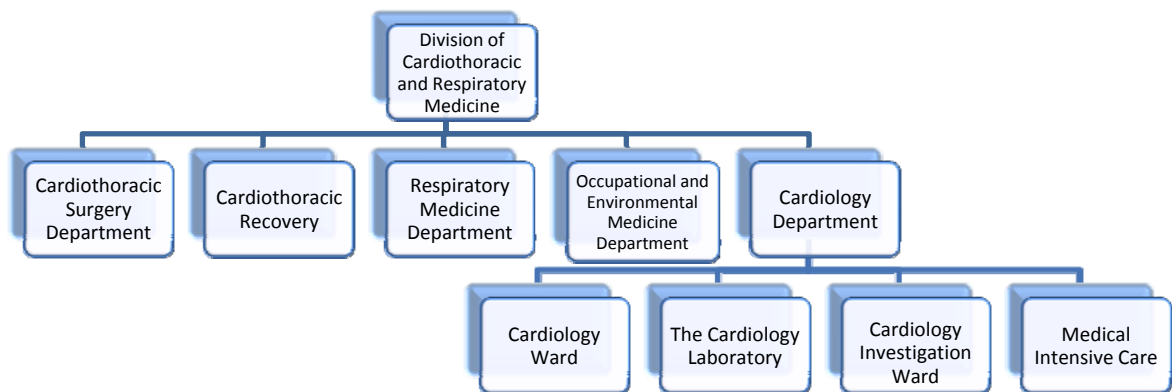


Figure 8: Organization of the Cardiology Department

The Cardiology Department has approximately 125 nurses and enrolled nurses and 30 physicians. The Cardiology Department consists of four wards (*see figure 8*), and performs specialized investigation and treatment of cardiac diseases. The Cardiology Department is a University clinic conducting research in the field of cardiology.

The most common diagnoses among the patients are Cardiac Artery Disease and Heart Failure. Coronary Artery Disease means that the coronary arteries (*see figure 9*), become narrowed and cannot supply the heart muscle with enough oxygenated blood. In Western countries, Coronary Artery Disease is the leading cause of death (www.who.int, 2009).

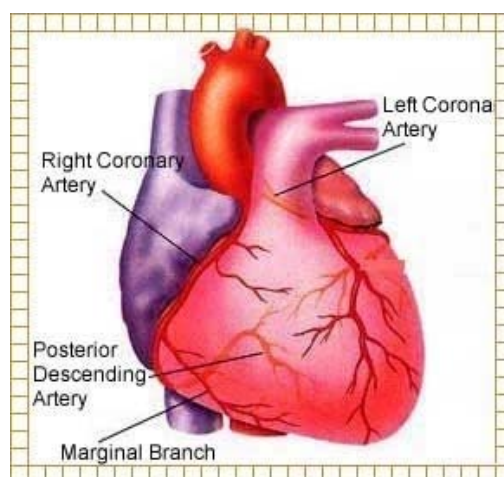


Figure 9: Coronary Arteries

(www.doctorndtv.com, 2009)

Change of lifestyle, medication and medical procedures can, in many cases, prevent or treat Coronary Artery Disease. Heart Failure is a condition where the output from the heart is insufficient for the physiologic needs of the body.

In the Cardiology Laboratory, 3,500 medical investigation procedures³ are performed yearly. The most common procedure is cardiac catheterization which can both diagnose and treat heart and blood vessel conditions. The most common type of cardiac catheterization is coronary angiography. Coronary angiography is a way to examine the inside of the blood vessels in the heart, using special X- rays and a catheter. A small incision is made in the skin of the arm or groin and the catheter is inserted into the artery. The catheter is threaded up to the heart, where the coronary arteries are examined with contrast fluid and X-rays are use to take angiographic images of the blood flow of coronary arteries. The angiographic images will show constricted areas or blockages. The images are used in the diagnosing process and the selection of treatment for cardiac disease (*see figure 10*).

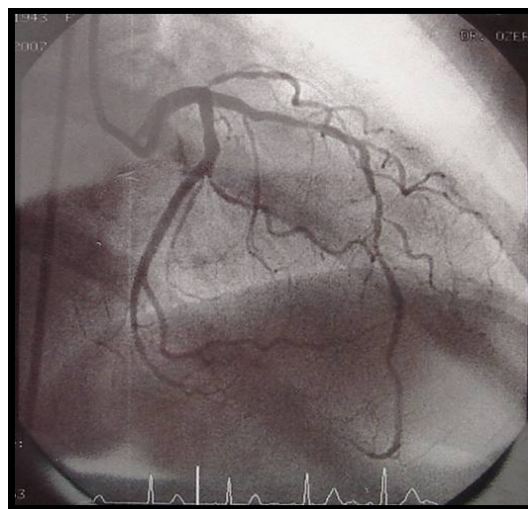


Figure 10: Coronary angiographic image

(www.ispub.com, 2009)

³ Data form 2008

The second most common procedure is percutaneous coronary intervention, PCI, (1,500 procedures annually), also known as angioplasty. During PCI, a tiny balloon is inserted into the narrowed heart artery. The balloon is inflated to widen the artery and usually a metal coil, called a stent, is inserted to keep the artery open (www.mayoclinic.com, 2009).

The Cardiology Ward is open 24 hours, seven days a week and has 30 beds for cardiac patients. The ward has 48 employees and the average length of hospitalization of patients in the ward is 2.7 days⁴.

The Cardiology Investigation Ward is run in close cooperation with the Cardiology Ward and Cardiology Laboratory. The Cardiology Investigation Ward is responsible for the preparation of patients going to cardiac procedures and observation in the recovery room after procedure. The patients stay in the ward for a few hours.

The Cardiology Investigation Ward has a rotating system with 3 nurses coming from the Cardiology Ward to the investigation ward every 6th month. To be allowed to work in the Cardiology Investigation Ward, the nurses should have two years of experience working with cardiac patients. The Cardiology Investigation Ward is open 7.30 to 20.30 from Monday to Friday and occupies 6 nurses, 2 enrolled nurses and 1 secretary. There is day-shift, middle-shift and evening-shift for the nurses. The one with middle-shift will be responsible for the recovery room.

There are no physicians employed at the ward, but every patient has a responsible doctor connected to the Cardiology Department which can be consulted when needed. This system makes the role of the nurses in the Cardiology Investigation Ward quite special and independent.

The participant observations are mainly conducted at the Cardiology Investigation Ward.

⁴Data from 2008.

4.2 Hospital Information System at UNN

The Northern Regional Health Authority made a decision that the same hospital information system should be implemented in all the hospitals of the region. The vision was to create a paper-less hospital and the patient record should become electronic. In 2004, a hospital information system developed by DIPS ASA was implemented at UNN in Tromsø.

One of the main functions of DIPS is the EPR. Modules such as nursing documentation and treatment planning, medication and prescription, workflow and process management can be integrated for management of several tasks at the same time. The information system from DIPS ASA is developed in close cooperation with health care professionals (www.dips.no, 2009).

The main part of the patients' record at UNN is electronic, but there are still paper-records in use. In the Cardiology Department every registered patient has a paper-record supplying the EPR. The paper-record mainly contains sheets of medication, ECG's, results from angiography, PCI and Cardiac Telemetry.

The Northern Regional Health Authority has an ICT-department (Helse Nord IKT) that provides services to all the units of the region. The Center for Clinical ICT-Systems (SKIS) was established locally at UNN in Tromsø and manned with clinicians in order to be the link between the divisions and the ICT-department.

4.3 DIPS Nursing Documentation

The Electronic Nursing Module of DIPS was integrated into the EPR-system and implemented in 2005 at UNN in Tromsø. The implementation was coordinated by SKIS. The project leader was responsible for introducing the system to the wards and for education of the users (nurses and enrolled nurses).

“It was an enormous transition from paper to computer. It was supposed to happen fast and the goal was to finish the implementation within a year. Some of the feed-backs I got regarding DIPS and the electronic nursing documentation was; “It is a lot of power here”; “If the nurses don’t come into this system, they will fall off; “It is important the nurses won’t lag behind.” Now as we have an active system, it is important that the nurses are in the same arena.” Project leader

Before 2005, all nursing documentation was hand-written in a separate kardex-system, and as the patient was discharged from the hospital, the nursing documentation was placed in the paper-record.

“The nursing documentation with a kardex-system was well-functioning. The handover was ok, one map for each patient, you leafed through the papers, reading and talking at the same time to the next shift. We were good at writing on the equipment-list; for instance intravenous lines and telemetry. But kardex and computer was mixed. We had to log in to find blood-sample results and x-ray results. The nursing documentation in DIPS is well-functioning.” Nurse 1 Cardiology Ward & Cardiology Investigation Ward

The expectations of implementing the electronic nursing documentation were: (1) to save time both in writing reports and in the nursing handover; (2) collecting all information about the patient in one place; and (3) improve the access to up-dated patient information. After the implementation of the electronic nursing documentation most of the information about the patient is collected in the same electronic system.

When the electronic nursing documentation was implemented at the hospital each ward scheduled one week for the implementation. Two weeks before the planned implementation, 7-8 users (mainly nurses) from the ward, called super-users, went to a one-day course. The content of the course was the structure of the nursing

documentation and practical use of it. The super-users were supplied with a written manual of instruction for the system. During the week of implementation the super-users had no practical work in the shifts, but were teaching and assisting the colleagues in practical use of the nursing documentation. Since there was varying knowledge in computing among the users, courses on general computer-use were arranged. Approximately 120 users from the hospital attended such a course.

“The wards did a great job. This was a positive process for the wards, to do something new together. This was really a major transition, going from paper to computer.” Project leader

One of the informants in the Cardiology Ward was a super-user during the implementation and was proud of the effort:

“It was valuable that I/we could use all our time on teaching our colleagues. We managed to teach all of them, old, young and with different computer skills. Some of them needed extra help, but they made it and are very good at this today.” Nurse 1 Cardiology Ward & Cardiology Investigation Ward

Further, the informants reflected on the expectations of the planned implementation:

“Before the implementation there were comments from doctors; they did not see the point of nurses writing their documentation into DIPS.” Nurse 1 Cardiology Ward & Cardiology Investigation Ward

The super-users came back for a follow-up course a few months after the implementation. They brought questions from the wards, feed-back on details not working in an optimal way, and there were discussions on solutions.

“It is difficult to plan how a system is going to work... you can't see the details before the system is in use. When you see the users in action then you

know how the system works. You see this again and again... we should be happy things are not fully developed, because then the users have an impact in the process of improving the system.” Project leader

The users log into the DIPS-system with a password.

“I log into DIPS several times a day. We are so many users; we cannot occupy a PC, by being logged-on.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

The nurses of the Cardiology Department can access the EPR of all patients hospitalized in the four wards of the Department. The doctors can access most patient records in the hospital. The enrolled nurses have access to the nurse module, but not the physician’s notes.

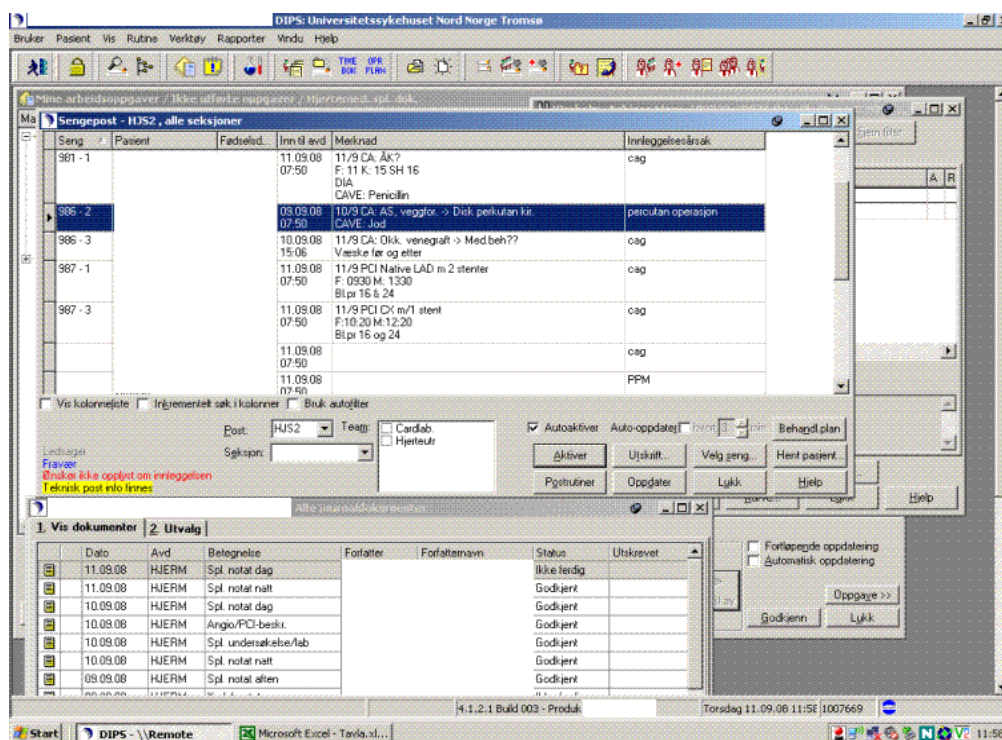


Figure 11: Overview of the patients in the ward

When writing a nursing note, the name of the patient is chosen from the list with the overview of the patients in the ward. When the patient name is selected from the list, the nurse can see the overview of the notes related to the patient (*see figure 11*).

The notes of nurses and physicians are mixed in the screen set up of this user. During observations, it seemed like nurses usually chose to mix the notes and the physicians chose to show only physicians notes, but they can access the nursing documentation when needed.

“It is better access to the notes of the nurses after they became electronic. I don’t see all the notes of the nurses on the screen, but know where to find them. For instance, sometimes when I follow up the patient after procedure and read in the nurse notes if there was pain after procedure.” Physician 1
Cardiology Department

“Most of the doctors don’t see the nursing documentation on the screen, but can open them if they need supplementary information, for instance episodes of chest pain during the hospitalization. I have received phone-calls from doctors with questions regarding the nurse notes.” Nurse 1 Cardiology Ward
& Cardiology Investigation Ward

For nurses, there are at many different kinds of notes: nurse day notes; nurse evening notes; nurse night notes; nurse admission notes; nurse transfer notes; nurse medical round notes; and nurse summary notes. When a nurse creates a new document the type of note is chosen and then an empty document with 12 keywords opens (*see figure 12*).

“The 12 keywords are great. They are like a check-point. Did you remember to write about this... useful especially when writing about a patient with a complex history. ... If you are updating yourself on a patient, instead of

reading the entire note, you can choose what keyword to read.” Nurse 1
Cardiology Ward & Cardiology Investigation Ward

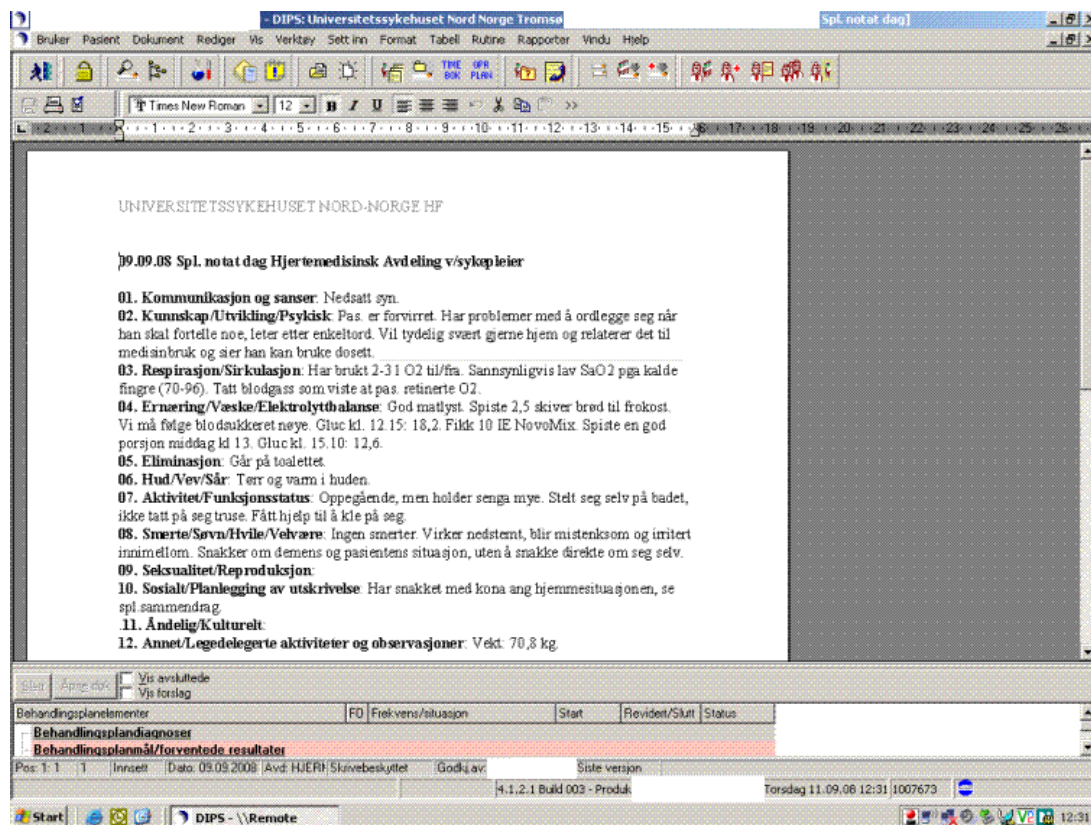


Figure 12: 12 keywords for the nursing documentation in DIPS

“The 12 keywords are open and cover the most topics. I use them in the Cardiology Ward, and I take away the keywords that are not written about. In the Cardiology Investigation Ward, I usually write short notes in free-text. For instance: “The patient is prepared for procedure”; “The patient is discharged and transportation home is organized.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

“The 12 keywords are good. I usually take them away in the Cardiology Investigation Ward and use free-text. In the Cardiology Ward they are a kind

*of guideline when you are writing nursing documentation.” Nurse 2
Cardiology Ward & Cardiology Investigation Ward*

Nursing classifications are originally included in the design of the nurse module of DIPS, as a basis for writing nursing diagnosis in the nursing plan. At UNN, a decision was made not to use classifications in the nursing documentation and instead base the nurse plan on free text. The 12 keywords were set up as a guide for the nursing documentation.

“The nurses wanted a nurse plan, such as in the paper –system: A problem, a goal and planned interventions. We considered if we should not have any nurse plan, only a free-text nurse record, but we decided to use the nurse plan and give every ward the opportunity to choose how to use it. We made the decision not to use classifications.” Project leader

There were lots of expectations regarding the electronic nursing documentation, but implementing that kind of system gives some restrictions compared to the former paper-based system.

“The nurses complained that elements were lost. In the paper-record we had the heading “History of diseases”. Now there is no place dedicated to this. Some wards place this information in the nurse plan. Other wards missed the overview of the patients in the transition. They were used to Word- or Excel-lists. For some administrative reason, other patients can be registered in a ward, even if they are not present. The nurses wanted an overview... “Who is here in my shift”? Now you can print out a list from DIPS for your ward. Lots of time is used in writing manual lists.” Project leader

SKIS has the role as the link between wards and the ICT-department with problems related to the use of DIPS.

“Our contact regarding issues of the nursing documentation is SKIS. We usually send an email with a request and then we often have a visit from SKIS. The ICT-department is contacted for passwords or computer failures.”

Nurse 1 Cardiology Investigation Ward

After the implementation of the electronic nursing documentation, all patients of the Cardiology Department were registered in the same place in the system. The patient overview for the Cardiology Ward, the Cardiology Investigation Ward, and the Cardiology Laboratory became problematic with more than 40 patients registered. Some of the patients were going to cardiac investigation and thereby sleep at the patient hotel and were not in the ward. SKIS was contacted for finding a solution to the problem.

“The solution of this problem was dividing into groups; three groups in the Cardiology Ward, -blue, green and red- and one day-patient group in the Cardiology Investigation Ward. A patient who is registered in the ward is at the same time placed in a group. When you print out an overview of the group, only the patients of the group are listed. It became much easier to have the overview.” Nurse 1 Cardiology Investigation Ward

4.4 Treatment Chain for Cardiac Catheterization

The referrals to cardiac catheterization come both as electronic and paper documents. The patients are referred from Outpatient Wards or Cardiology Wards for further investigation or treatment of Coronary Artery Disease. The waiting time for the procedure is estimated to be 12 weeks (frittsykehusvalg.no, 2009).

The arrival day or Day 1, the patient comes to the hospital for registration and has a medical consultation by an assistant physician of the Cardiology Department and a nurse at the Cardiology Laboratory. The patient receives information on the planned procedure and for most patients the night is spent at the Patient Hotel of the hospital.

The nurse at the Cardiology Laboratory writes a short note after the consultation *“Patient has come for investigation and is registered for the procedure.”*

The assistant physician makes a medical dictate and makes a hand-written protocol for medications⁵.

The cardiologist responsible for the cardiac catheterization usually sees the patient mainly at the table for investigation in the Cardiology Laboratory. The assistant physician conducting income registration and discharge letters has the responsibility to follow up messages regarding medication for the patients.

“Sometimes I doubt if the message regarding medication has been executed. Today the medication sheet is scanned, after the patient is discharged from hospital. You cannot find the current medication sheet in DIPS during the hospital stay. ... It would be of help if I who don't see the patient so often, could write into DIPS the medication I want the patient to have during the stay.” Physician 1 Cardiology Department

There are three invasive laboratories for cardiac catheterization at the Cardiology Laboratory. Every afternoon, the next day's program is composed in Excel and made available for the employees. This means three lists are manually written: it is not possible to copy names and dates of birth from DIPS and paste into another document.

“It is not possible to copy and paste in DIPS. If you have written note on the wrong patient (which occurs regularly) you have to delete what is written and rewrite it again, into the document of the right patient.” Nurse 1 Cardiology Ward & Cardiology Investigation Ward

⁵ DIPS is working on an electronic protocol for medications.

A short medical history is written into the program and the type of procedure that is scheduled.

“I miss the possibility to set up a program over patients, without opening each patient and manually transfer name and date of birth, with the risk of errors. If we could copy and paste for the angiography program, we would have a better list, because errors occur.” Physician 1 Cardiology Department

As a preparation for the next-days program, the evening-shift nurse at the Cardiology Investigation Ward goes through the scheduled patients’ record with check-points. A short note is written into the nursing documentation that the record is checked.

The procedure day, or Day 2, the patient comes to the Cardiology Investigation Ward in the morning and is prepared for the procedure. The nurses and enrolled nurses receive patients for preparation from 7.45 to 9.30. The preparation includes information, shaving of groin or arm and setting up an intravenous line.

When the preparation is finished, a short note that says *“the patient is prepared for procedure”* is written into the nursing documentation.

The scheduled program is usually followed, but since cardiac catheterization is also an emergency procedure for patients with myocardial infarction, delays occur frequently.

“The patients going to cardiac catheterization often have to wait. There is a program published, but we often call the Cardiology Laboratory to ask how they are proceeding and which patient is next on the program.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

When proceeding in the program, the Cardiology Laboratory makes a phone call to the Cardiology Investigation Ward that the next patient can be followed by nurse or enrolled nurse to cardiac catheterization.

“We have a plan (Excel-sheet) for the day. We have phone-contact all the day with the Cardiology Investigation Ward. We often have an overview in the morning regarding available beds in the ward, the opening time, lack of staff...They bring patients to procedure and also back to the ward afterwards, so we have a lot of contact during the day. This is a kind of production line (løpende band).” Nurse 2 Cardiology Laboratory

The cardiac catheterization is performed in an invasive investigation unit (*see figure 13*), at the Cardiology Laboratory, by a cardiologist supported by two nurses. During the cardiac catheterization, the patient lies on an X-ray table. The patient is monitored with ECG, blood-pressure and oxygenation through the procedure. A third nurse is following the procedure through the window and is responsible for following the continuous ECG-registration on the screen and the manual registration in a book, noting what equipment and medicines have been used. The third nurse is responsible for the nurses' documentation in the patient's health record.



Figure 13: Invasive investigation unit at the Cardiology Laboratory

(www.unn.no, 2009)

“When a new patient arrives to the Cardiology Laboratory I open the income-note of the physician and the blood-sample results. This provides information about the patient and possible special considerations to take into account. I usually don’t read the nursing documentation before the procedure; I get the information that I need from the income-note and blood-samples.” Nurse 1 Cardiology Laboratory

Some of the cardiac patients coming for investigation have a complex medical history and have been hospitalized for a time in the Cardiology Ward or other wards.

“I sometimes read the nursing documentation before procedure. When the patient has a complex medical history I do read the notes from the last 1-2 days, to have an overview of the situation. Is the patient oriented in time and place and what kind of medication is given?” Nurse 2 Cardiology Laboratory

Both the nurse and the cardiologist in the Cardiology Laboratory document the performed procedure. The cardiologist makes a medical dictation which is sent electronically to the fellow office center. Usually the dictation is written into DIPS later the same day; these dictations are of high priority.

“The doctor makes a detailed medical dictation after procedure. I write a note with information to the nurse who is observing the patient after procedure, for me that is the reason for making a note. ... In the former paper-system, we wrote a note in the nursing documentation on the same sheet as was used in the patients’ ward. In DIPS, we make a note called Nurse-investigation Laboratory Cardiology Department, we do that on all patients. When we open a new document, it is an empty sheet, there are no 12 keywords to write on. We write in free-text.” Nurse 1 Cardiology Laboratory

The nurses don't write diagnoses or treatments in the nursing documentation, but what kind of procedure was performed, the location of the incision and the time for finishing the procedure.

“After coronary angiography, I write a note like this: ‘Performed angiography through the groin. No complications in the procedure. Finished at 14.25’. After PCI, the note is longer, it is more to write about; pain, medication, intravenous fluid.” Nurse 1 Cardiology Laboratory

After the cardiac catheterization, the staff from the Cardiology Investigation Ward are called by phone that the patient can be followed back to the ward. When the nurse or enrolled nurse comes to transport the patient back to the Cardiology Investigation Ward, they receive a short oral report on the procedure from the cardiologist and the Laboratory nurse.

“When we go to the Cardiology Laboratory to transport the patient back, we get oral report about the procedure. If the patient has had a PCI we also get a written sheet on what is done. When we come back to the ward I always read the nurses’ note in DIPS. The medical note from the cardiologist is written later.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

After coronary angiography the patient is usually transported in a wheel chair back to the Cardiology Investigation Ward and is allowed to relax in an armchair. The blood-pressure and pulse is measured after arrival. After 30-60 minutes, the patient is mobilized and is allowed to walk in the corridor.

After PCI, the patient is transported in a bed back to the recovery room or the Cardiology Investigation Ward for observation and monitoring. There are four beds in this room. Two beds on each side and a desk/working station with a laptop is placed in the middle. Females and males are placed in the same room. For more privacy, a curtain can be placed around the bed.

When a new patient arrives to the recovery room, the nurse places leads on the chest for continuous ECG-and pulse-registration. A probe is placed on a finger for measurement of oxygenation. The nurse also attaches ECG-leads to the patient, and prints out a paper-version of the 12-lead ECG.

An electrocardiogram or ECG is a record of the electrical signals of the heart beats. Each heart beat is triggered by electrical impulses from the right chamber of the heart. The pattern and the rhythm of the ECG are used to diagnose heart conditions. The ECG-record is usually 1-2 pages in A4-form (*see figure 14*).

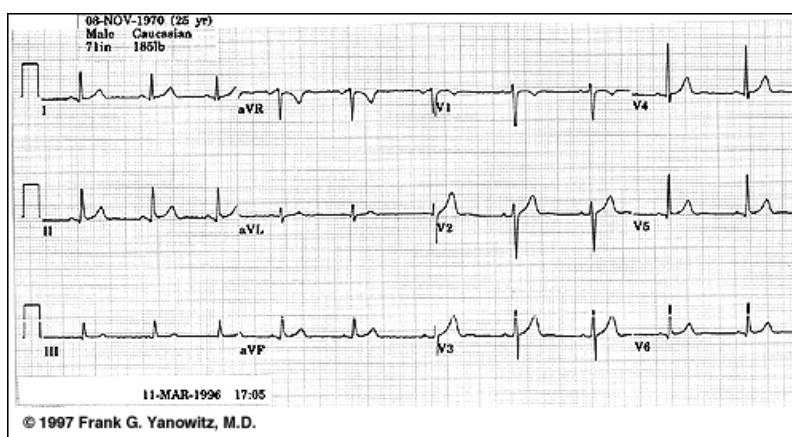


Figure 14: Example of ECG-record

(www.cvirtie.utah.edu, 2009)

The paper-ECG is stored in the paper-version of the health record. If the patient is having an ECG conducted for the first time, and there is no paper-version of the health record, a new paper record is composed. Scanning of ECG-records for the EPR seems to give a reduce legibility⁶.

“When you are working and investigating Coronary Artery Disease, as we do, we often have a need to compare ECG’s. But often we don’t find the

⁶ There is not a user system at UNN for electronic storage and interpretation of ECG. There is ongoing work finding an electronic solution for ECG.

earlier ECG's. They are in another place or lost. I can see the need for electronic ECG's." Physician 1 Cardiology Department

One nurse is responsible for the observations in the recovery room, and is not allowed to leave the room as long as there are patients connected to ECG-registration. The nurse colleagues in the Cardiology Investigation Ward transport patients to and from the Cardiology Laboratory bring medication from the medicine room and assist when needed, since the responsible nurse has to stay in the recovery room for observations of the patients.

The nurse in the recovery room is logged into DIPS all the time, when patients are observed. When the arrival of a new patient is announced, the nurse prepares the nursing documentation of DIPS and makes a "patient search", chooses the patient name and date of birth from a list in the system. The names on the list are written in red or black text: red text means the person is dead. In the search for patient name quite many are written in red.

"I always open the note from the Laboratory Nurse. One of the essential things is the time for finishing the procedure. That time influences how long the patient has to stay in bed and when he can leave the ward." Nurse 3 Cardiology Ward & Cardiology Investigation Ward

The nurse clicks on "active patient" and the health record is opened. The nurse opens "new document" and imports a phrase called "PCI-observation -sheet" (*see figure 15*), and pastes it into the new document in the nursing documentation. During the observation and monitoring, the ECG, pulse and blood-pressure are measured frequently. The values from the measurements are registered in this sheet, nothing is handwritten. The nurses register observations continuously in the nursing documentation and the note is usually not signed until the observation is finished or the patient is transferred to another ward.

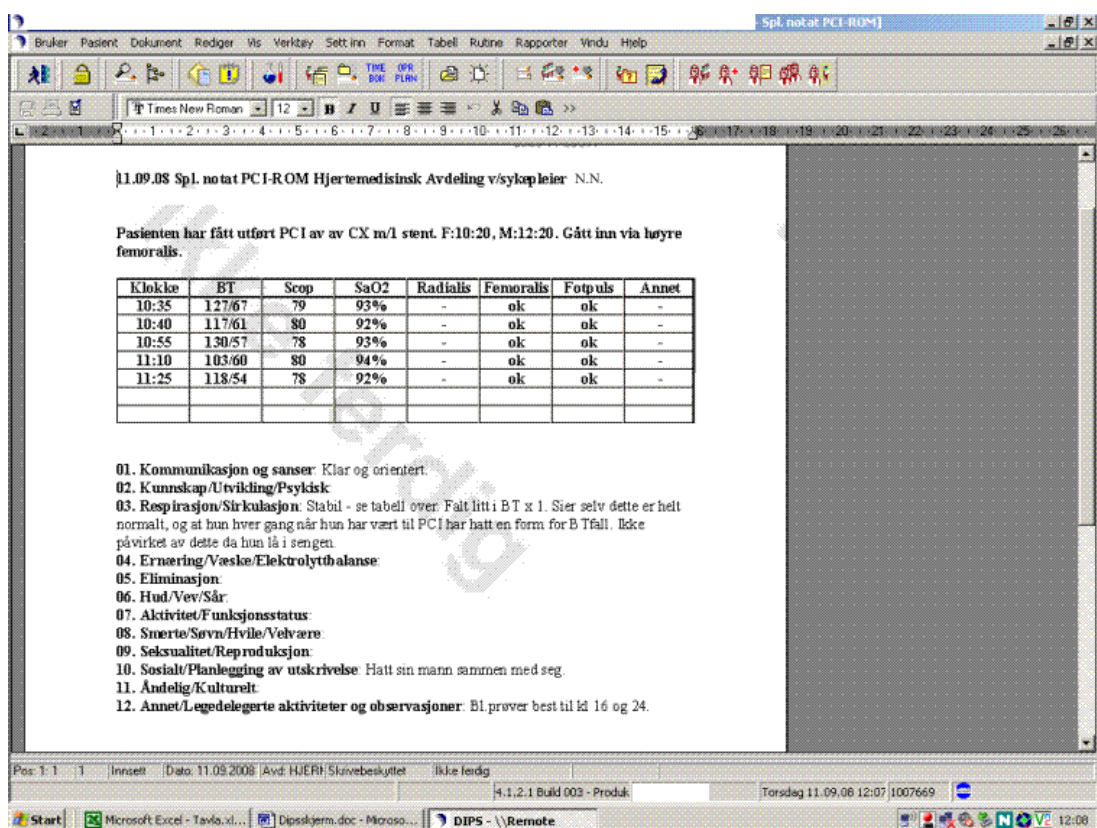


Figure 15: PCI observation sheet

“We are obliged to have a sheet of observation in the recovery room in the Cardiology Investigation Ward. In the beginning we used 1 centimeter of the paper-sheet, the hour the patient was observed. This was scanned into DIPS after discharge. This was a waste of resources. Instead we (I) made a table, called a phrase, which is pasted into the document, with the objects we observe. We also have made other phrases, for instance 6 minutes test of walking for examination of pulmonary hypertension.” Nurse 1 Cardiology Investigation Ward

When the nurse is switching between the four patients in the nursing documentation, the “open patient” has to be closed (X in the right corner) and another “active patient” has to be chosen, and the active working document has to be found. Only one active document can be open at a time. If someone else “activates” the patient,

the message “not finished” (ikke godkjent), will appear on the screen. Usually no one else can write a new document while the last one is not finished and un-signed. Nurses say this can sometimes be a problem, since more than one can have information to document at the same time. The solution to this problem at this ward is that another person can “sign” the document. If there are changes needed for the document, the author has to make a new version.

“Two documents cannot be open at the same time. The document has to be signed and closed before the next nurse can make a new note. I cannot write a note from the medical round if the nurse responsible for the patient’s room has started to write her day-note and has not signed it. The solution is that we sign for each other, and have to make new versions of the document.”

Nurse 1 Cardiology Ward & Cardiology Investigation Ward

The nurses explained that some of the reasons for the documents not being finished when they are closed, are un-predictable shifts with interruptions when writing records and several things going on at the same time.

“As I have middle-shift in the Cardiology Investigation Ward I often read the nursing documentation. Some shifts are until 14, and then another nurse will follow up the patient the last hour and give a report to the next shift. Then a well-written note is important.”

Nurse 4 Cardiology Ward & Cardiology Investigation Ward

The patient is observed in the recovery room after cardiac catheterization for 1-4 hours, and the night is usually spent at the Patient Hotel. Patients with a need for more observations have to stay overnight in the ward.

In early January 2009, the Cardiology Investigation Ward became closed during the night, due to economic considerations. Patients that need to stay overnight for observation are transferred to the Cardiology Ward in the evening. Because of this

change of routines, a cardiologist visits the Cardiology Investigation Ward during the afternoon, to decide who is going to the Patient Hotel and who is staying in the Cardiology Ward.

“I don’t think the doctors read the nursing documentation in this situation; they talk to the nurse on shift and ask for information about the patients’ condition after procedure.” Physician 1 Cardiology Department

In the recovery room, there is a book, where a sticker with patient-ID and procedure is manually registered. This book is for annual registration of patient-numbers.

Discharge day, or Day 3, the assistant physician from the Cardiology Department informs the patient about the results of the cardiac catheterization. Further treatment is decided and the patient is discharged from the hospital. The hand-written medication protocol is scanned into the EPR after discharge of the patient.

Transportation home is arranged by the secretary of the ward.

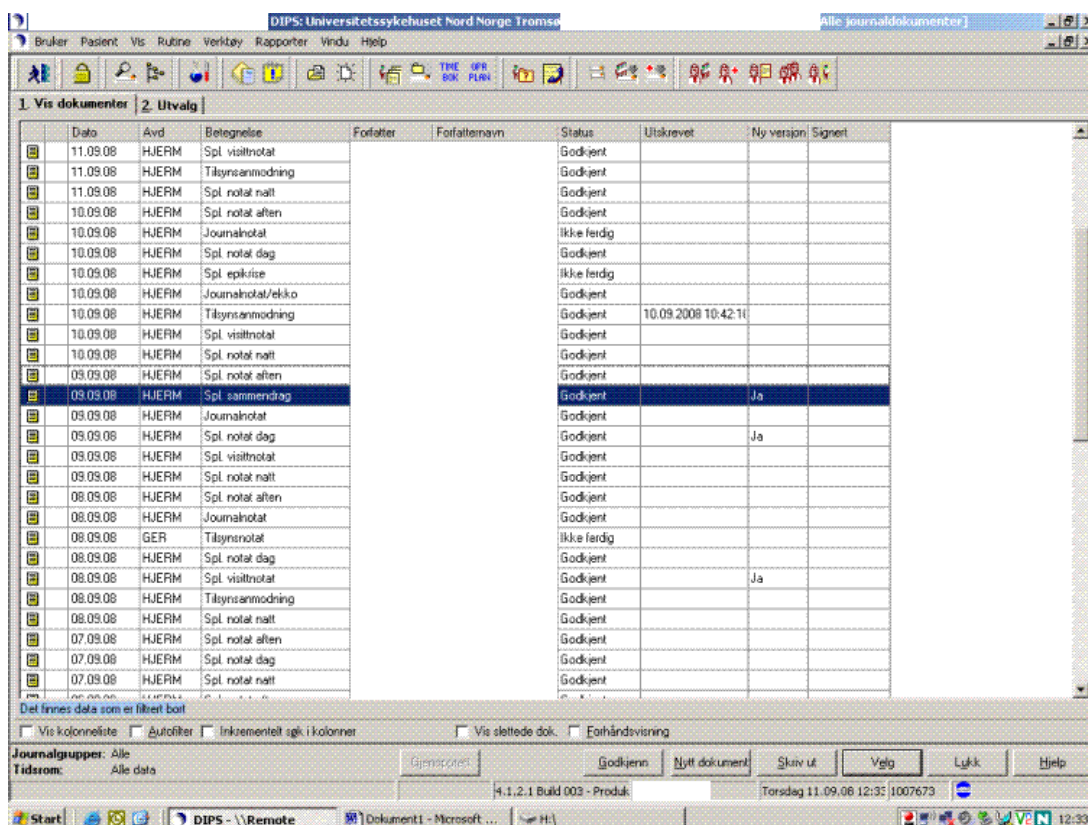
“I see the nurse notes on my screen set-up and I often read them. For instance, before I discharge a patient after electrical cardioversion, I usually read the nurse notes for more information about the patient.” Physician 2 Cardiology Department

The physician dictates the discharge letter, and it is sent electronically to the patient’s General Practitioner through the Norwegian Health-net.

Messages in the cooperation between the Cardiology Investigation Ward, the Cardiology Ward and the Cardiology Laboratory are mainly given by phone.

4.5 Nursing Documentation in the Cardiology Investigation Ward

One of the informants characterized the work related to cardiac catheterization as a production line. There is high activity and 3-4 notes can be written only during the day-shift in the Cardiology Investigation Ward (see figure 16).



	Dato	Avd	Beleggelse	Forfatter	Forfatternavn	Status	Utakrevet	Ny versjon	Signert
	11.09.08	HJERM	Spl visittnotat			Godkjent			
	11.09.08	HJERM	Tilsynsnotat			Godkjent			
	11.09.08	HJERM	Spl notat natt			Godkjent			
	10.09.08	HJERM	Spl notat aftern			Godkjent			
	10.09.08	HJERM	Journalnotat			Ikke ferdig			
	10.09.08	HJERM	Spl notat dag			Godkjent			
	10.09.08	HJERM	Spl epikrise			Ikke ferdig			
	10.09.08	HJERM	Journalnotat/ekko			Godkjent			
	10.09.08	HJERM	Tilsynsnotat			Godkjent	10.09.2008 10:42:10		
	10.09.08	HJERM	Spl visittnotat			Godkjent			
	10.09.08	HJERM	Spl notat natt			Godkjent			
	09.09.08	HJERM	Spl notat aftern			Godkjent			
	09.09.08	HJERM	Spl sammendrag			Godkjent		Ja	
	09.09.08	HJERM	Journalnotat			Godkjent			
	09.09.08	HJERM	Spl notat dag			Godkjent		Ja	
	09.09.08	HJERM	Spl visittnotat			Godkjent			
	09.09.08	HJERM	Spl notat natt			Godkjent			
	08.09.08	HJERM	Spl notat aftern			Godkjent			
	08.09.08	HJERM	Journalnotat			Godkjent			
	08.09.08	GER	Tilsynsnotat			Ikke ferdig			
	08.09.08	HJERM	Spl notat dag			Godkjent			
	08.09.08	HJERM	Spl visittnotat			Godkjent		Ja	
	08.09.08	HJERM	Tilsynsnotat			Godkjent			
	08.09.08	HJERM	Spl notat natt			Godkjent			
	07.09.08	HJERM	Spl notat aftern			Godkjent			
	07.09.08	HJERM	Spl notat dag			Godkjent			
	07.09.08	HJERM	Spl notat natt			Godkjent			

Figure 16: Example of number of notes

“I don’t think the number of notes is a problem. When we work as we do, with a kind of production line, we have to have updated notes, to know where the patient is in the system. The only way for this is to make short notes when needed. Even though there are a number of them. There is a reason for every update. Most of the notes are read.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

The notes are often quite short (see figure 17).

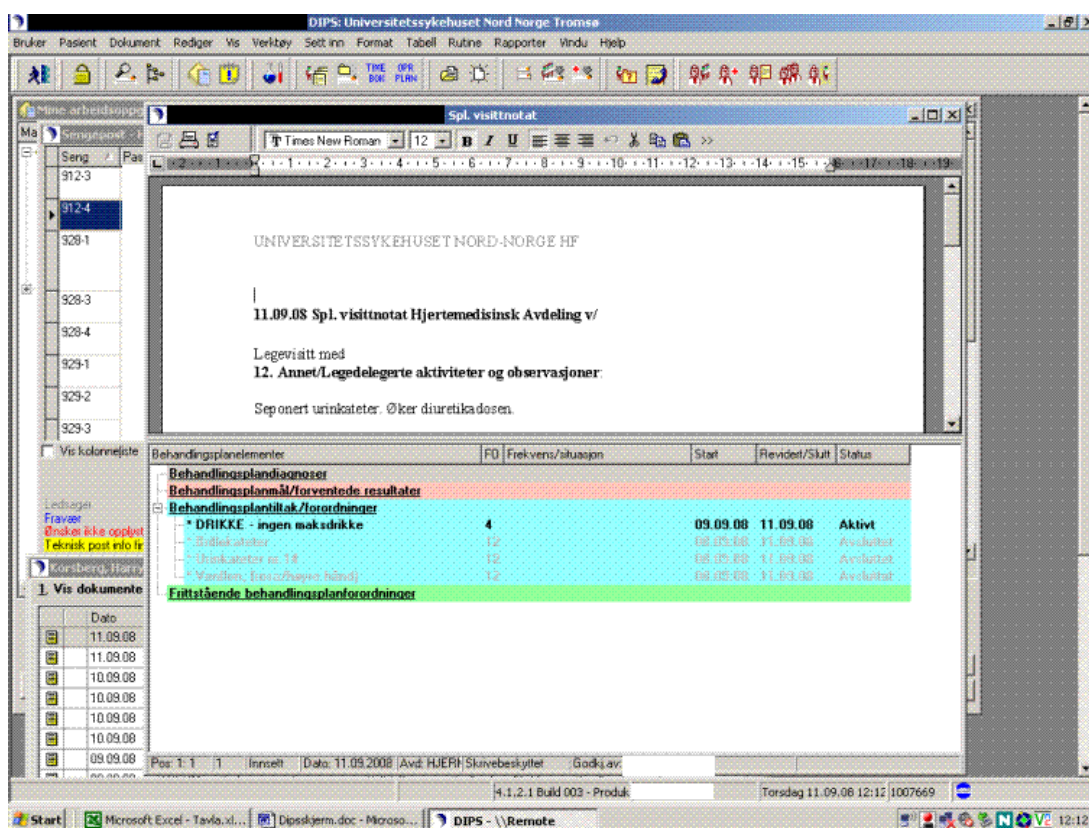


Figure 17: Example of a short nursing note

“On a day-shift in the investigation ward, as a patient, you usually meet at least 3 nurses/enrolled nurses. One will prepare you and set up an intravenous line, and then a short note is written. After investigation in the laboratory, it can be another nurse transporting you back to the ward, and a new note will be made. We have lots of short notes. It could happen that another nurse will take over the observations and a new note is composed. The evening shift will write a note. This is a choice we have taken in the investigation ward; to write a lot of notes and sign them. The alternative is to have one note standing all the day unsigned. If a note is unsigned in this ward, it is usually a transfer-note. Patients are here only for a short time.”

Nurse 1 Cardiology Investigation Ward

The access to a computer is essential for writing notes into DIPS. During the observations, there was sometimes a queue for using the laptops.

“We have 4 laptops in the Cardiology Investigation Ward. They are mostly placed in the staff-room. If we have to check something regarding the patient, we leave the patient. We rarely bring the laptop into the patient room, except the recovery room where a laptop is placed.” Nurse 4 Cardiology Ward & Cardiology Investigation Ward

A solution to the queue problem for computer-access and the time-consumption related to log-on is following “work around”:

“In the investigation ward, we have a lot to do in the morning when we prepare patients. If one of us is logged in, we all sometimes use the same account. That means the text is written and signed by a colleague, but in my name. It is too time consuming to log in for every patient.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

“The patient has to go to examination right now, I write a short note in the name of the colleague logged in. I don’t have time to log her out and log me in.” Head Nurse 1 Cardiology Ward & Cardiology Investigation Ward

Another reflection on the laptop-use is there is not a desk with a chair when all are in use. When there is a queue for writing reports before the nursing handover, the consequence is nurses using laptops on the sofa (*see figure 18*).



Figure 18: Writing nursing documentation on the sofa

“There is often a queue for using the laptops when we write reports close to the nursing handover. The ergonomic considerations related to sitting on a sofa with a laptop is not optimal.” Nurse 1 Cardiology Ward & Cardiology Investigation Ward

In the Cardiology Investigation Ward, the patient stay is short, usually only a few hours, and the main part of the nursing documentation in use is free-text.

“I write reports mainly in free-text in the Cardiology Investigation Ward; the nurse plan is not used.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

In the Cardiology Investigation Ward, there is a white board placed in the staff room. This white board (*see figure 19*), is essential for the overview of patients and for coordination of the patients for the investigations.



Figure 19: White board in the Cardiology Investigation Ward

“The white board is in use all the time and we update it frequently. It is used for the name of patients, what procedure, the time for mobilization and which nurse is responsible for the patient.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

In the handover situation in the staff room, this board is used all the time, supplemented by a paper printed out from the patient overview in DIPS, with patient names and diagnoses. The computer and the nursing documentation are usually not used in the handovers.

“In the handover at the Cardiology Investigation Ward, we sort out the most important elements; the kind of procedure and results, history of heart- and lung disease and at what time patients can leave for the Patient Hotel. We use the white board and the patient-list from DIPS in the handover-situation. The rest is in our head. Every new shift will have a new and updated patient-overview; it is printed out right before the end of shift to be as much updated as possible. The overview can have many changes in just one hour, since we can have a fast change of patients in the recovery room.” Nurse 1 Cardiology Investigation Ward

4.6 Nursing Documentation in the Cardiology Ward

The Cardiology Investigation Ward and the Cardiology Ward are run in close cooperation, and some of the nurses rotate and work in both of the wards. The patients who need to stay overnight after cardiac catheterization are transferred from the Cardiology Investigation Ward to the Cardiology Ward.

When a patient is transferred the nurse from the Cardiology Investigation Ward gives an oral report to the nurse in the Cardiology Ward, and there is also a written report.

“I mean that what is not written is not done, that’s why I try to document what I have done during the shift; check of incision, blood-samples, chest pain, if the IV line is ok, plan for discharge. I try to document things that are important to know for the one who takes over the responsibility for the patient in the other ward.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

Patients in the Cardiology Ward often go through cardiac catheterization during the hospitalization, sometimes with a complex medical history. An up-dated nurse plan is mentioned as important for the continuity of care during the hospital stay.

“In the Cardiology Ward, we have an active use of the nurse plan. It contains medical diagnoses, interventions (medical) and is usually updated. We use it in the handover situation.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

In the Cardiology Ward, there are three parallel nursing handovers, one for each group. There is a computer in the handover-rooms and the nurse/team-leader giving the report is logged in and reads from the nursing documentation for each patient.

“When I am team-leader in the ward, I open most of the other nurse notes to see what the ones caring for the patients have written. The one who is team-leader gives medications, has medical round with the doctor, gives reports in handover and does not see the patient so much during the shift.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

In some cases, the nurse from the on-coming shift was also logged on and read the notes parallel to the report.

“When I have the evening-shift, I often read the notes from the day-shift. It depends on how well I know the patients of my group. If there is a patient

who has been hospitalized in the ward for a long time, and has need for complex caring, I often read many notes, to have an overview of the situation.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

“In the handover, I read the nurse plan and almost always open the notes from that day. I often read the notes of the doctor as well.” Nurse 4 Cardiology Ward & Cardiology Investigation Ward

The informants in the Cardiology Ward were mainly satisfied with the electronic nursing documentation, but the use of the nurse plan was mentioned as problematic during the interviews.

“The nursing documentation is well-functioning, but we have to make an agreement on how to use the nurse plan. The problem is that we use the nurse plan in different ways. Some nurses are writing a long medical history which is not always relevant, and other are writing small interventions that we also write in another place, for instance rinse of the IV line. We use the nurse plan also for medical intervention such as coronary angiography. If that is not up-dated, we don’t know if the patient is going or has already gone through the examination.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

One of the informants had the following comment on practical use of the nurse plan:

“The nurse plan cannot be changed after the document is signed. If you want to make changes in the nurse plan, you have to open a new document, even though you are finished with writing a nursing note. And you cannot let the note be unsigned for hours, because there are others who need access too. So when the note is signed, the nurse plan cannot be changed. It would be easier to have up-dated nurse plans if you could make new versions in an easy way.” Nurse 3 Cardiology Ward & Cardiology Investigation Ward

When patients are transferred to the Cardiology Ward after cardiac catheterization they sometimes need to continue the monitoring of the heart beats. Cardiac Telemetry is a way to monitor the heart beats of mobile patients (*see figure 20*). Wires and electrodes are attached to the skin of the chest. A small box transfers the ECG-signal to computer screens in the Medical Intensive Care, where a nurse is observing several parallel ECG's of patients in the hospital.



Figure 20: Cardiac Telemetry

(www.medgadget.com, 2009)

The results of the observations with Cardiac Telemetry are given by phone to the Cardiology Ward (and other wards) before the nursing handover. At the Cardiology Ward, the results of the Cardiac Telemetry are hand-written into a book. The group nurse transcribes the results into a telemetry card in the paper-record and also into the nursing documentation in DIPS. The Cardiac Telemetry results are written three times.

“The patients usually have telemetry for less than 24 hours. When the observation is finished, a hand-written telemetry-card is placed in the record. Other solutions have been checked out, but rejected. The best solution would be if the observation-nurse in the Medical Intensive Care could write directly into a telemetry-report in DIPS, linked to the patient with telemetry. This is not possible because of jurisdiction regarding patient records.” Nurse 1 Cardiology Investigation Ward

“Regarding results of telemetry, I mainly see the small hand-written cards in the Medical Intensive Care.” Physician 1 Cardiology Department

4.7 Reflections on the Electronic Nursing Documentation

The main impression after conducting the observations and interviews with nurses and the staff in the Cardiology Department is satisfaction with the electronic nursing documentation as an artifact for communication and exchange of information in the daily work. The informants made suggestions for improvement of some elements and there is a wish for an agreement on how to use the application.

5. Discussion

In this section the information infrastructure of the national health care services and the hospital information system of UNN are discussed. The implementation and the role of the electronic nursing documentation are discussed as a part of the information infrastructure for health care services and the hospital information system. The use of the electronic nursing documentation in the Cardiology Department and the exchange of nursing care information are discussed, guided by actor-network theory, with a focus on inscriptions and translations of the system.

5.1 Information Infrastructure of National Health Care Services

The main goal for the work on a national ICT-structure (*National Health Plan, 2007-2010; Te@mwork, 2007*) is to focus on continuity of care and increase the quality of care. The intension is to let appropriate use of ICT contribute to better support of patient care and work processes.

The Norwegian government is working on up-grading the information infrastructure for health care services. Implementation Plan 2007 points out that ICT solutions designed for health care are supposed to change work practice and generate long-term socio-economic benefits and effects. Most of the health care sector is using EPR, but the information flow is not working as hoped for.

“It takes time to develop good, functional solutions which will not only replace today's paper-based solutions, but will also be used in a new everyday reality with changed and more appropriate forms of work. And, not least, it takes time before all collaborative players are at the same level.”
(Implementation Plan, 2007 p.6)

In terms of information infrastructure, different elements of an information infrastructure are integrated through standardized interfaces. In this case, the Health-

net with the ebXML-standard represents the interface through which the actors at different levels of the specialized and primary health care are supposed to use as a medium for communication and exchange of medical information.

Hanseth (2002) stresses that information infrastructures are open and evolve over a long time. The system is open and in use all the time and is serving a large community. Each new feature or version has to fit/operate with the existing infrastructure or installed base working at that moment. Related to the National ICT-strategy, the process of improving the electronic collaboration in health care services takes time. The process is in an intermediate phase with one foot in the electronic world, and the other in the paper-based world. UNN and the northern health region can show good results in routine exchange of structured information- high numbers of electronic referrals, discharge letters, blood-sample requisitions and the results from examinations. All the hospital organizations are using the same information system, which creates a platform for communication.

Further, Hanseth (2002) argues that there is neither limitation in participating and contributing to the design and deployment of an information infrastructure, and the development of an information infrastructure has no beginning or ending.

The work on developing and delivering hospital information systems and EPR systems is open in Norway; different actors are present in the field. KITH has the role for endorsement of the standardization of the systems in the health care services, and the goal is to improve the electronic collaboration and communication.

5.2 Information Infrastructure of the Hospital Information System

A hospital information system consists of different levels and actors. At the hospitals of UNN, DIPS is implemented as a universal hospital information system. The software of DIPS and the hardware of the technology equipment represent the main actors that connect together the other actors related to patient care. The EPR,

with related implemented modules related to treatment, care and patient administrative systems, represents one of the main functions of the system.

The ICT department is responsible for support when technical problems occur. The informants of the study mainly mentioned the ICT department as helpful in log-in- and password troubles and in situations with laptops out of order. The operation of the whole system is vulnerable; days when the system is down are described as silent days and the employees have problems in performing their work. Secretaries can't do the registration and administrative work, nurses and doctors can't access important medical information. Services such as X- ray and blood-sample results delay the treatment of patients when they are not available. Systems support is essential for a large organization.

SKIS is responsible for following up problems related to use of the program. Some wards have had need for local tailoring of the application or finding solutions that are appropriate for the ward. In one case, the Cardiology Department needed help to organize the overview of the patients registered in the system in a better way. The solution was to divide the patients in the system into groups.

The vendor DIPS has the main role, in delivering and supporting the information system for the needs of the hospital organization; new versions have to fit with the existing infrastructure in use. Comparing old and new versions, the EPR of DIPS gives the possibility to scan important paper-based medical information.

The intention with EPR was to collect the patient information into one place and make access to important information better.

“Paper records were often difficult to find, and could be messy and unclear especially for patients who have been a long time in the system. The implementation of Electronic health records in general is great progress,

even though some things could be improved.” Physician 1 Cardiology Department

The information infrastructure in the hospital is in an intermediate phase with one foot in the electronic world and the other in the paper-based world. The vision of a paper-less health region has come far, but still there are some elements to work on. Results, such as ECG-records and protocol for medication are still in paper-version, only accessible for healthcare professionals present in the ward. The Cardiac Telemetry report is handwritten several times before it is typed into DIPS.

“The intention of a paper-less hospital is not as it was meant to be. There are a lot of papers, lists. But it is much easier to find information in the computer system, than in the paper-system. The overview is much better. The transition from paper to computer was actually successful.” Nurse 1 Cardiology Investigation Ward

The program for cardiac catheterization is typed into an Excel-sheet because it is not possible to copy and paste the name and date of birth of the patients. Maybe the cardiac catheterization program could be produced in DIPS, like the surgical planning system⁷. In the process of cardiac catheterization, there are several actors that play a role: the technology, the medical information, the cardiologist, the assistant physicians, the nurses and enrolled nurses in the different wards of the Cardiology Department. An interactive system would increase the overview of the program; there would be less phone-calls and it would increase the electronic communication between the involved wards. In terms of security, there would be fewer errors when programs are not manually written.

“An interactive system would be great and then we could follow on the screen how they are proceeding. There would be less phone-calls.” Nurse 2 Cardiology Ward & Cardiology Investigation Ward

⁷ An available module of DIPS

5.3 Information Infrastructure of Electronic Nursing Documentation

When the rest of the hospital information system was electronic, it was a natural development that nurses also should document their work electronically into the same system. This is a socio-technical development described in the words of T.P. Hughes (1994):

“Technological Momentum infers that social development shapes and is shaped by technology”.

Obstfelder et al. (2007) stresses that for successful implementation of telemedical applications, the user involvement is important, and also the addressing of technological troubles. In the implementation of electronic nursing documentation, the courses for the super-users before the implementation are an example of user-involvement. The super-users were given the possibility to come back after a couple of months with problems, and they were met with a forum for solutions. There was a working group working on DIPS implementation problems the first six months after the implementation.

According to the Norwegian Nursing Association (NSFID, 2007), the nursing documentation is a part of caring for patients. Further, high quality nursing documentation is a way to achieve the best possible quality of treatment and care.

Hellesø & Ruland (2001) argue that the EPR is a working tool for nurses and supplies accurate and adequate information about the patient. The main objective for implementing electronic nursing documentation was to improve the quality and continuity of patient care.

ICT both shapes and enables organizations, but also constrains and restricts (Hanseth & Monteiro, 1998; Orlikowski & Robey, 1991). In the development of information infrastructures, there is a tension between standards and flexibility; the interplay between technological issues on one side and human, social and

organizational issues on the other side. If we consider the nursing documentation as an information infrastructure and that the work on information infrastructures can be seen as implementation of standards and specifications, the Norwegian Nursing Association wants to improve the national and local nursing documentation and the exchange of nursing information through the use of ICNP classifications. In this situation, there is a tension between national vision and the local use; classifications and coding of nursing documentation and the documentation in free-text. In this case, the nurses both use documentation in free-text and the kind of classification with 12 keywords that structures the text. With short-time stay for hours the nurses used free-text. With a more complex nursing history, the nurses use the 12 keywords. The project leader for the implementation of the electronic nursing documentation stated:

“What is nursing?

For many nurses it is a huge transition from caring for patients to making written plans. You are working in many contexts at the same time. Nurses might have a good practical overview of what to do, but to put in a paper/plan can be difficult.” Project leader

The nursing plan/treatment plan is inscribed into the system of electronic nursing documentation. But the organization allows individual use of the nursing plan in the wards. In this case, the nursing plan is used for both medical and nursing interventions. It is up-dated in order to provide overview of medical procedures and nursing interventions. It is also used in the handover situation at the Cardiology Ward.

5.4 Exchange of Nursing Care Information

Manias and Street (2000) and O’Connell and Penney (2001) argue that the nursing documentation, the groundwork for the nursing handover, is an important medium for communication of nursing care.

Some of the expectations for the implementation of the electronic nursing documentation were to use less time in both writing the nursing documentation and in the nursing handover.

“I use less time on a computer-note than contra handwritten. I think the content of the notes are identical before and after.” Nurse 1 Cardiology Laboratory

“I think the length of the notes is identical. But it takes a longer time to log-on and find the patient, compared to the old system. Earlier some papers could be missing in the patient record and postpone the procedure. Now everything is stored in the same place.” Nurse 2 Cardiology Laboratory

Nurses have a strong oral handover tradition (Manias & Street, 2000). The nursing handover is the main medium for exchange of nursing care information, but also presents a meeting point and a forum for discussions.

“... I think the oral report of the nursing handover is important; there is a need for a meeting-point. But the handovers could be shorter and then there would be a need for also reading the nursing documentation”. Project leader

The nursing handover is an element for discussion in most wards, because they are time-consuming. There are projects on silent reports in several places. The aim is to make the nursing handover shorter and let the nurses/ health care professionals read the notes instead.

“The nursing handover in our ward is longer after the implementation. We always use the PC and have to log in, and thereafter activate every patient in the report to have access to the notes. It takes time. Regularly we have to discuss shortening of the nursing handover.” Head Nurse 2 Cardiology Ward & Cardiology Investigation Ward

The nurses in the Cardiology Investigation Ward can write several notes on a patient during a shift. They characterize the work with cardiac catheterization as a production line. The nursing note is used to up-date the situation and demonstrates where the patient is and what interventions are performed. Even though the notes were short, the nurses of the ward found them as important for up-dating the situation, since there are several health care professionals involved. Through observations and interviews, it can seem like the nurses of the Cardiology Laboratory seldom read the nursing documentation before the cardiac catheterization.

“We read less nurse records and more medical records after DIPS was introduced. It is quite special when we are not caring for the patient, but performing a medical treatment. We need to know the medical history and special precautions.” Nurse 1 Cardiology Laboratory

The nurses of the Cardiology Investigation Ward seem to read many nursing notes: they use them as an up-date before and after procedure.

For the continuity of care in the process of cardiac catheterization, the nursing notes present performed interventions and deliver important information for the actors involved. One of the informants reflected:

“What we write about for preparation in the Cardiology Investigation Ward should be of interest for the nurses in the Laboratory. The patient might be anxious or had sedative medication. We might have had problems with an intravenous line and used another place for incision than usual. We write a nursing note right before we bring the patient, and that one should be read.”
Nurse 3, Cardiology Ward and Cardiology Investigation Ward

In the Cardiology Investigation Ward there is a high volume of notes. It takes some time to open every one and read them. One of the informants reflected:

“Instead of opening each nurse note, an option from the menu, continuous screen, will show the written text of the notes and not only the dates of the notes. I think there are few users of this function, probably most people don’t know about this.” Nurse 1, Cardiology Investigation Ward

Cardiac catheterization includes several health care professionals, and there are several processes going on at the same time. In some cases, both the nurse and the physician will document the same procedure or event but have different elements to write about. In order to reduce the amount of text, one of the informants reflected:

“I think some nurses write too much in their notes and also things that should not be written, like medical information about procedure. For instance, detailed information on stents and where they are placed. That is the responsibility of the doctor. We try to work on this, but because we have a rotating system for nurses, we often fall back into the same pattern.” Nurse 1, Cardiology Investigation Ward

But there are different points of view, another nurse mentioned the law of health care professionals and stated:

“... what is not written is not done...” Nurse 3, Cardiology Ward and Cardiology Investigation Ward

One of the informants reflected:

“If I have a message regarding a patient going to cardiac catheterization, I have to call or tell the next nurse in the process the message. It is not enough only to write it into the nursing documentation, I am not sure if the note is read.” Nurse 3, Cardiology Ward and Cardiology Investigation Ward

In this situation with a high volume of nursing notes, oral handovers and messages, both written and oral communication seems to have an important place supplementing each other in the process of cardiac catheterization.

In the process of cardiac catheterization, the cardiologist responsible for the procedure sees the patient mainly in the operating room. Messages regarding the procedure and medications go through the responsible assistant physician. During interviews, two physicians mentioned that they regularly use the nursing documentation as a source for information about the patient and the procedure. They are especially interested in knowing about chest pain and complications that can occur after procedure.

The electronic nursing documentation is an element for sharing nursing care information. A long-term impact of the implementation of electronic nursing documentation is better access to the nursing care information for other health care professions.

5.5 “Work arounds” regarding the Nursing Documentation

The design of a system is also called inscription.

The nurses of the case described the workload as partially high with unforeseen circumstances. The daily work can be hard to plan. When the nurses are writing nursing documentation they are often disturbed with other tasks or duties. Then they close the application and continue later. The consequence is that notes are standing “un-signed” in the system. When a note is un-signed for a patient, no one else in the ward can write a new note until the note is signed. The system is designed with a point of view that the author should sign their own notes and this blocks the access for colleagues to write new notes until the note is signed. In an active setting with several parallel working processes, where the nurse notes are used for up-dating the

situation; the translation or working around for this situation is the nurses sign each other's notes, when they need access to a new nursing note document with up-dates.

“The strength of inscriptions, whether they must be followed or can be avoided, depends on the irreversibility of the actor-network they are inscribed into.” (Monteiro, 2000).

Another work around is the fact that in order to save time, the nurses write nursing notes in the logged-in colleague's name. The system is set-up so that the note should be written in one's own area of access and that the author should be logged in.

The nurse plan is supposed to be used for planning and evaluation of nursing interventions. In the short-time stay at the Cardiology Ward, it is also used for medical interventions as an indicator for what is planned and performed for the patient stay. During the interviews, the nurses of the ward suggested regulation of the use of the nurse plan.

6. Conclusions

The objective of this study was to find if the implementation of electronic nursing documentation can contribute to the national aim of increasing the continuity of care in health care services through appropriate use of ICT-applications.

The study was conducted at the Cardiology Department of UNN with the intention to find out what impacts the electronic nursing documentation has on the flow and exchange of nursing care information in the process of cardiac catheterization.

The Cardiology Department represents wards with short-time stay for the patients. There are several actors and parallel processes involved in the treatment chain of cardiac catheterization.

The nurses involved in cardiac catheterization use the nursing documentation several times during a shift. It is common to compose more than one nursing note for a patient each shift. The nursing notes are used for messages and up-dates of the process and situation. In the exchange of nursing care information, both oral and written messages are used. A written nursing care message or note is often also communicated orally in the nursing handover.

During the oral nursing handover in the Cardiology Ward, several of the nursing notes are opened and read.

For the continuity of care in the process of cardiac catheterization, the electronic nursing documentation presents performed interventions and deliver important information for the actors involved. A long-term impact from the implementation of electronic nursing documentation in the cross-disciplinary work related to cardiac catheterization is access to the nursing care information for all parts of the treatment chain.

This should imply increased continuity of care through “access to relevant medical information when needed” for all parts of the treatment chain.

A quantitative research approach could have contributed with more amounts of data, but still the results would need interpretation. A qualitative research approach has given an in-depth understanding of the field and the parallel processes that involve several professions in health care services. A comparative study of a larger scale, including other short-time wards, could give more information in this field.

7. References

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7.3 Personnel Communication

Project leader	Interview September 2008
Nurse 1 Cardiology Ward & Cardiology Investigation Ward	Interview January 2009
Nurse 2 Cardiology Ward & Cardiology Investigation Ward	Interview January 2009
Nurse 3 Cardiology Ward & Cardiology Investigation Ward	Interview January 2009
Nurse 4 Cardiology Ward & Cardiology Investigation Ward	Interview January 2009
Nurse 1 Cardiology Investigation Ward	Interview September 2008
Nurse 1 Cardiology Laboratory	Interview December 2008
Nurse 2 Cardiology Laboratory	Interview December 2008
Physician 1 Cardiology Department	Interview January 2009
Physician 2 Cardiology Department	Interview January 2009
Head Nurse 1 Cardiology Ward & Cardiology Investigation Ward	Interview September 2008
Head Nurse 2 Cardiology Ward & Cardiology Investigation Ward	Interview September 2008

8. Appendix

Acronyms used in the text

ANT	Actor Network Theory
CEN	European Committee for Standardization
DIPS ASA	The vendor of the hospital information system at UNN
ebXML	Electronic Business Extensible Markup Language
ECG	Electrocardiogram
EPR	Electronic Patient Record
ICNP	International Classification for Nursing Practice
ICT	Information and Communication Technology
KITH	Norwegian Center for Informatics in Health and Social Care
NANDA	North American Nursing Diagnosis Association
NIC	Nursing Intervention Classification
NOC	Nursing Outcome Classification
NSF	Norwegian Nursing Association
NSFID	Forum of Norwegian Nursing Association for ICT and documentation
PCI	Percutaneous Coronary Intervention
RCT	Randomized Controlled Trials
SKIS	Center for Clinical ICT-Systems
UNN	University Hospital of North Norway
VIPS	Swedish Nursing Classification System, Well-being, Integrity, Prevention and Security