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Evaluation of an innovative telemedicine project

- Learning from the development and implementation process

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Master's Thesis in Telemedicine and E-health (TLM-3902)

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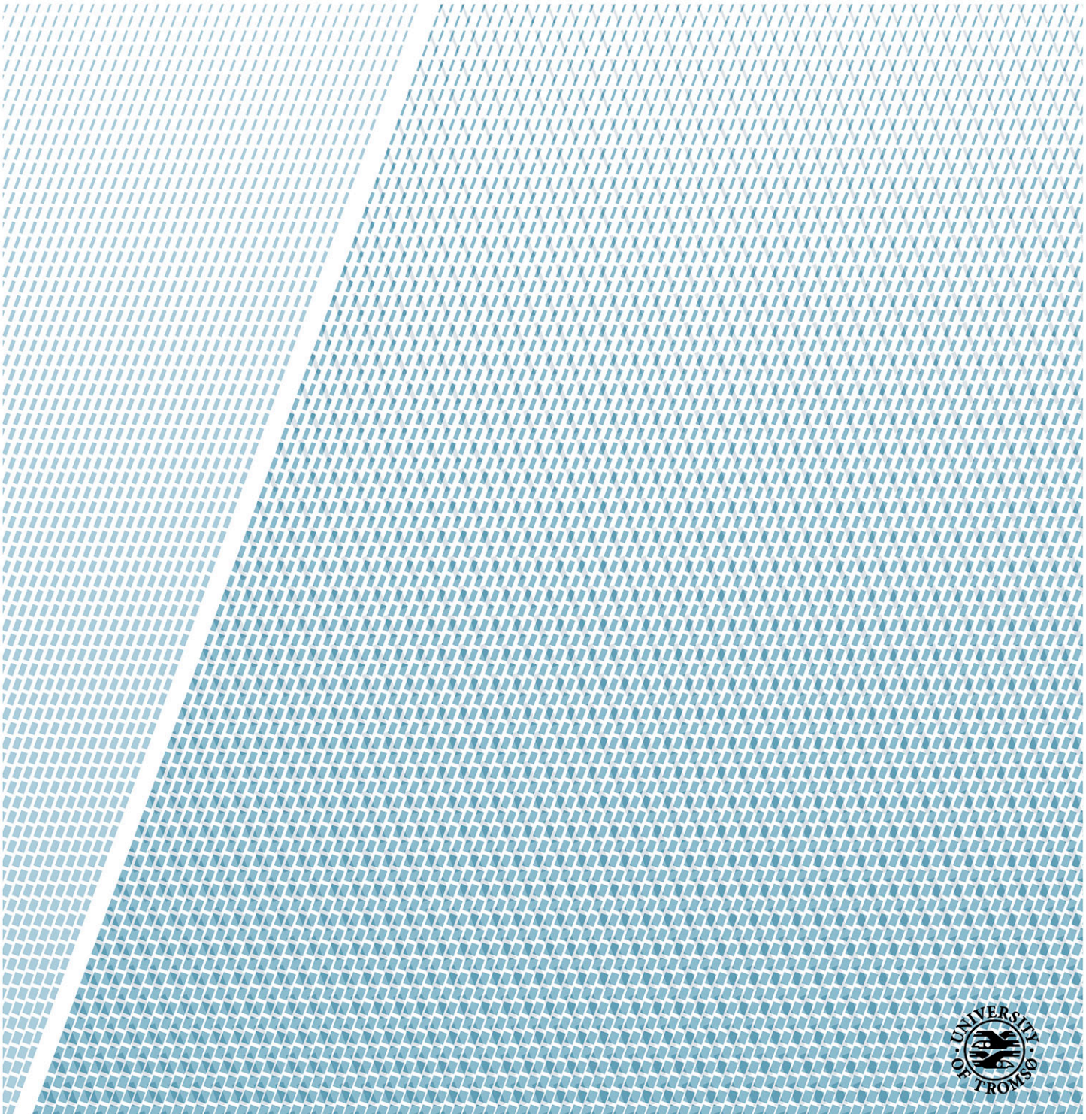

Abstract

Purpose: The objective of the study was to identify what type of strategy there are suitable for evaluating an innovative telemedicine project that aims for sustainable use in complex and heterogeneous healthcare work practices. It was explored which factors shape the development and implementation process and what type of knowledge there can be generated from innovative telemedicine projects.

Context: The study was based on the evaluation of a Danish research project, evaluating alternative cross-sectorial treatment offers for elderly acute ill medical patients. One of the treatment offers included access to three telemedicine solutions (sharing of vital values, video conferencing and a hotline). In the project it was experienced a gap between the initial expectations and actual outcome, which led to that the evaluation approach was changed alongside with the project emerging.

Methods: To facilitate an understanding and explanation of the gap between initial expectations and actual outcome, the evaluation was approached as a narrative process analysis, where information system development was viewed as situated socio-technical change. Data was collected through reviewing relevant project documents and from qualitative semi-structured interviews. 11 informants in total were interviewed including users of the technology, project managers and the supplier of the technology.

Results/Discussion: The results showed that the development and implementation process had been complex and influenced by multi-dimensional elements, resulting in the shaping of the process being multifaceted. Especially it is assessed that as long as the technology is not seen as a potential solution to a challenge and do not correspond the needs of the user it will be challenging to achieve a successful implementation. The implications of the study underscored that it is important to pay attention to which evaluation approach is chosen when one wants to generate valuable knowledge from an innovative telemedicine project. The study illustrated that it is not applicable to evaluate an innovative telemedicine project through a rigorous RCT design but instead research methods exploring the underlying processes of the socio-technical interaction must be addressed to view telemedicine interventions and achievements as complex and ongoing innovations in natural settings, helping to learn from the success and failures.

Keywords: implementation Study, evaluation, innovative telemedicine projects

Preface

This thesis has been submitted to fulfill the requirements for the Master Program in Telemedicine and E-health at UiT the Artic University of Norway. The research study has been carried out in collaboration with the Department for Emergency Research at the hospital of Southern Jutland, Denmark.

Working with this master thesis has been an inspiring process, which has given me the opportunity to expand my knowledge and horizon within the field of telemedicine and e-health.

I owe my greatest gratitude to my supervisor Gunner Ellingsen for his inspiring supervising throughout the process of writing this master thesis. Furthermore do I owe a gratitude to Christian Backer Mogensen, head of the Department for Emergency Research at the hospital of Southern Jutland, for giving me the opportunity to become a part of the ACCESS-project and letting me evaluate the telemedicine solution in the project.

I would also thank my friends in both Denmark and Norway, and my always faithful family for being supportive during the whole master program.

Finally, I want to give a special thank to my two hardworking and smart friends, Ida Lindhardt and Ditte Bruus Nielsen for taking their time to read through this thesis.

Tromsø, May 2015

Marie Birkemose

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List of abbreviations

ICT: Information and Communication Technology
ACCESS: Acute Combined CarE for Seniors in South Jutland
RCT: Randomized Controlled Trail
EMR: Electronic Medical Records
RIS: Radiology Information System
PACS: Picture Archiving and Information System
IT: Information Technology
GP: General Practitioner
WHO: World Health Organization
ATA: The American Telemedicine Association
EBM: Evidence-Based Medicine
MAST: Model for ASsessment of Telemedicine
IS: Information System
SOF I SYD: local coordination forum for the hospital of Southern Jutland's admission area

The words, IS and ICT will be used interchangeable of each other in this thesis.

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1 INTRODUCTION

Information and Communication Technology (ICT) is recognized as one of the most significant developments over the past decades and its emergence and widespread deployment within healthcare is constantly increasing(1,2). Healthcare providers as well as health policy makers are paying increased attention to the potential of ICT, addressing issues such as delivering high standard care to an aging population and the increased number of people suffering from chronic and long-term illnesses. The increasing need for medical care leads to exponentially rising healthcare expenditures. New technological innovations are therefore designated to help challenge the system to focus on innovations that prevent the increased health issues, support self-care and deliver care to people in their own home environment.

Telemedicine is a type of ICT that will move treatment and monitoring of patients away from hospitals and to the familiar surroundings of the patients' own homes or to alternative treatment offers(3). Telemedicine applications are believed to make it possible to provide healthcare in new and more efficient ways and is seen as one of the keys that open the door to the health services of the future(3). By preventing acute deterioration in patients' condition and reduce number of admissions to the hospital, a higher quality of treatment and a better quality of life for the patients can be provided (4).

Denmark is known as one of the world-leaders using ICT in healthcare(5,6), and there is a common understanding between policy makers, the healthcare sector and the general population that use of ICT including telemedicine is one of the answers to the challenges the healthcare sector is facing. However, despite the awareness of benefits and the ongoing development of the technology, Denmark is still experiencing challenges related to development and implementation of new technologies and all most all telemedicine projects in Denmark are run as research studies or on a local basis(7). In 2010 Ekeland *et al.*(8) published a systematic literature review looking at the effectiveness of telemedicine. This review concluded that high quality evidence on how to inform policy makers' decisions is still lacking and large studies with rigorous

designs are needed to improve evidence on the effects of telemedicine interventions on health, satisfaction with care and costs. However, considering the nature of innovative telemedicine projects it can be challenging to generate high quality evaluations in terms of rigorous designs, and it may instead be appropriated to consider alternative evaluation methods highlighting the importance of understanding telemedicine as a complex development process(9,10).

Development, implementation and use of new ICT systems for healthcare are often associated with great challenges, due to the complexity of heterogenic healthcare work practices(10). The adoption of a new ICT system can be seen as an involved socio-technical process of negotiation, and the implementation or adjustment of an ICT system will often affect and involve the whole organization, across different actors including non-technical and technical actors(11). To ensure successful implementation and evaluation of telemedicine it is of great importance to emphasize that introducing new innovative telemedicine applications is a complex and multifaceted intervention and the intervention must be seen as interplay between technical and social factors (12) The constantly evolving field of telemedicine therefore drives the need for more research-based knowledge about the reciprocal adaption process between technology and social challenges(2).

1.1 MOTIVATION

I am educated as healthcare technology engineer, and have since engineering school been particular interested in the interplay between technology and humans with a special focus on telemedicine. I decided to move to Tromsø to participate in the master program in Telemedicine and E-health, to expand my knowledge within this area. In spring 2014 I started to look for an interesting project for my master thesis. I searched both in Denmark and Norway. During my search I came in contact with a project in the Southern part of Denmark, the ACCESS-project (Acute Combined CarE for Seniors in South Jutland). I was offered to perform the evaluation of the telemedicine solution applied in the project, which I found as a very interesting case for my master thesis. A few weeks later I was offered a part-time position as project manager on the project, which I could possess in parallel with writing my master thesis. I possessed the position as project manager from the 6.1.2014 until 2.1.2015.

The ACCESS-project was designed as a Randomized Controlled Trail (RCT), evaluating four different courses of treatments for elderly acute ill medical patients. The project is described into more details in chapter 4. At the establishment of the project a telemedicine solution was included in the RCT study and planned to be evaluated using quantitative methods. When I first was in contact with the project it was clear that the telemedicine solution had faced several challenges during the first month of the project leading to that the technology was not used properly and did not live up to the initial expectations. This resulted in a demand for an alternative evaluation of the telemedicine solution, which led to an adjustment of the study protocol, in which the evaluation of the telemedicine solution was no longer to be evaluated through the RCT-study but instead through qualitative evaluation methods.

I find it motivating to explore the reasons why the project experienced a gap between the initial expectations and the actual outcome. Especially, seen in the light of the increasing focus on ICT and telemedicine in Denmark. Even though Denmark is rated as a world-leader within healthcare technology, the complexity of implementing new technology in healthcare is still seen as a challenge.

When I started in the position as a project manager the project had already been running for 7 month and most technological and organizational challenges had occurred and had been dealt with. To avoid conflict of interest being both a project manager and a researcher this study will mainly focus on the decisions taken prior to the start of the inclusion period and on the first 7-month of the inclusion period.

1.2 RESEARCH QUESTIONS

The main research question of this master thesis is to explore:

What type of strategy is suitable for evaluating innovative telemedicine projects that aim for sustainable use in complex and heterogeneous healthcare work practices?

Based on the evaluation of the ACCESS-project the research question will be explored through answering the following sub-research questions.

RQ1: What does the gap between initial expectations and actual outcomes consist of?

RQ2: Which factors shape the development and implementation process in innovative telemedicine projects?

RQ3: Why do different stakeholders have different expectations towards telemedicine systems?

RQ4: What type of knowledge can be generated from innovative telemedicine projects and what can different stakeholders learn from such projects?

1.3 STRUCTURE OF THESIS

The thesis is organized as followed: Chapter 2 deals with how the use of telemedicine constantly evolves over time and how new technologies are perceived in Denmark. Chapter 3, explores the theory used for interpretation and analysis of the empirical findings. In chapter 4, the research setting of the ACCESS-project is described. In Chapter 5, the method used for collection of the empirical fieldwork and reflections upon my role as a researcher is covered. Chapter 6, contains a presentation of the case study and the empirical findings obtained through the data collected, including the case narratives clarifying the influences and effects on the development and implementation process. In Chapter 7, the results are discussed in the light of the theory examined in Chapter 3. Finally in Chapter 8, will there be made a conclusion on the main implications of the study with respect to the stated research questions.

1.4 CONTRIBUTIONS

I hope that this master thesis will contribute to an increased understanding of I) The influences and effects which has affected the gap between the initial expectations and actual outcome in the ACCESS-project, II) An more general understanding of which strategies there are sustainable for evaluation of innovative telemedicine projects. It is attempted to achieve these contributions through a qualitative socio-technical evaluation of the ACCESS-project.

This master thesis has formed the basis of the official reporting to the Danish Health and Medicines Authority, in relation to evaluation of the telemedicine part of the ACCESS-project(13). Furthermore, it is sought for this master thesis to form the basis for publication of partly an abstract to the European Telemedicine Conference 2015 and partly a paper for a relevant journal.

2 DENMARK AND HEALTH INFORMATICS

Denmark is a small country with a population of 5.6 million and has one of the highest per-capita incomes worldwide(14). The country is considered to be a modern welfare state with a healthcare system based on the principle of free and equal access to healthcare for all citizens. Thus, the vast majority of health services in Denmark are free of charge for the users and the healthcare services are largely financed through taxation at the state level(15). The country is divided into 5 Regions and 98 municipalities and the Danish healthcare system consists of two sectors containing primary and secondary care. The primary healthcare sector is responsible for general health problems and care. The primary healthcare sector consists primarily of private (self-employed) general practitioners (GPs), pharmacies, dentists, specialized practitioner services and of the municipalities who are responsible for homecare, long-term care and social care(5). The secondary sector includes the hospitals, which are responsible for providing care for patients with medical conditions that require specialized treatment, equipment and intensive care. The Danish hospitals are owned and run by the five Regions of Denmark(15). Over the next 10 years Denmark will invest more than $7.6 billion in building 16 new hospitals including 8 super hospitals, which is leading to that Denmark in the future will have larger and more specialized hospitals where the use of health Information Technology (IT) will be intensified(16).

For several of years, the use of IT for health purposes has been recognized as an essential element of delivering high quality healthcare in Denmark. In a historical perspective it started back in the late 1980's where a Danish primary care doctor convinced the head of IT, in the respective IT-department that sending clinical messages electronically would be of particular benefit to primary care physicians(5). This project was the starting point of what later is known as MedCom, an independent nonprofit organization established back in 1997, which became a part of the Danish national IT strategy. MedCom is today developing and expanding communication standards for the most common communication flows between municipalities and hospitals and between medical practices, hospitals, and pharmacies. Furthermore, they carry out pilot projects in the areas of the Internet, telemedicine, and dentistry. In 2000 MedCom was

recognized as a permanent player with a clearly stated mission, *"To contribute to the development, testing, dissemination and quality assurance of electronic communication and information in the health care sector with a view to supporting coherent treatment, nursing, and care."*(5).

For many years, the development of health ICT in Denmark has been based on the cooperation of all involved parties: the government, the regions, the practice sector, the municipalities, and the system providers. This has brought developments to a level where nearly all-basic information from the various sectors has been digitized. The digitalization of the Danish healthcare system has led to increased focus on expansion of common digital infrastructures and the exchange of data across sectors. Efforts have been concentrated on integrating and streamlining the way patient data are accessed and shared across the healthcare system to make all relevant patient data accessible when needed(17). The nation-wide adoption of health informatics has resulted in common use of health information systems and can be seen in terms of that all GPs and all hospitals are using electronic medical records (EMRs), integrated ePrescribing, Radiology Information Systems (RIS) and Picture Archiving Information Systems (PACS) and all communication and standards are managed through a central network, MedCom(5,6). The widely implementation and adoption of new technology is assumed to be a result of a small and wealthy population with a tax-funded universal healthcare system and strong primary care and hospital infrastructure. Furthermore, it is assumed that the general acceptance among the population of using IT in the communication with the public authorities has an influence in the widely implementation and adaption. In 2013, 84 % of the population between 16-74 years used the Internet every day or almost every day and 83 % of the population uses the Internet for interaction with public authorities(18).

There is no doubt that Denmark has come a long way when it comes to digitalizing the healthcare sector and there still is a general consensus among policy makers that health ICT must be a greater part of future healthcare(19). This is elaborated in a publication from 2012(19) published by the Danish Minister of Health, The President of Danish Regions and the Chairman of Local Government Denmark, in which it is stated; "*There is an extensive need for digital solutions in the healthcare system. In the coming years,*

growing numbers of senior citizens and the introduction of new treatments will increase the pressure on health sector resources. In addition, both patients and the health care system can benefit from empowering patients to manage their own health by providing better access to their own health data by the use of telemedicine and home-monitoring technologies."

The great advances in the use of health IT has been noticed abroad, where Denmark is recognized as one of the world-leaders within using ICT in healthcare(5,6), supported by the following headlines; "*Denmark is among the forerunners*"(19), "*Denmark Leads the Way in Digital Care*"(20), "*Denmark, World Leader in Health IT, Tests New Systems with US Companies*"(21).

However, even though Denmark is one of the world-leading countries within using ICT in healthcare, there are still challenges related to developing and implementing successful ICT solutions. According to Kierkegaard(6) one of the down sides of Denmark's early adoption of e-Health, is the difficulty experienced in getting consistency between systems. This is a result of years with no strict guidelines and standards resulting in interoperability problems. As a consequence of these problems the Danish Government, Danish Regions and Local Government Denmark have launched several strategies and initiatives to deal with these challenges. Looking specific into telemedicine, in 2012 a national action plan for telemedicine was created to ensure seamless and secure collection, communication and storage of personal health data from patients' homes to healthcare providers across the country(4). The Danish Regions published their own telemedicine strategy in 2011, which included working on common standards to ensure the interoperability of telemedicine systems with e-Health systems used by hospitals, GPs and other care providers(22). Furthermore, a common-public strategy for digital welfare 2013-2020 has been launched with a focus on faster dissemination of proven, effective and cohesive welfare solutions(23). As an example the strategy is aiming to establish a common national telemedicine infrastructure on the basis of the existing e-Health infrastructure, which should be tested and expanded before the end of 2015.

During the last couple of years the perspectives of increased focus on telemedicine has been a hot topic in Denmark and currently there are 345 active telemedicine project registered in the national database for telemedicine, managed by MedCom(7). Of these projects, 129 are categorized as being fully implemented on daily use. However, almost all of these projects are run on a local basis leading to a lack of experience and knowledge of how to implement telemedicine on a large scale. One of the main goals for the national telemedicine action plan is therefore to ensure large-scale testing of telemedicine solutions and to test telemedicine solutions in areas where there is not much documented experience(4). The national action plan involve five initiatives; one focusing on national dissemination of *telemedical assessment of ulcers*, which will be the first telemedicine solution used on a national basis. Two projects about home monitoring on a large scale: *Clinically Integrated Home Monitoring* for five groups of patients involving three different regions and selected local governments. And finally two pilot projects which takes place in the psychiatric area. The results of the plan will form part of the work of a future digital welfare reform.

The Danish Government, Danish Regions and Local Government Denmark have initiated several initiatives to speed up the dissemination of telemedicine solutions that they know already worked(22,24). Considered that the technological development is constantly evolving and the number of devices linked to the Internet will continue to rise gives the ideal conditions for a world where medical and personal devices are melting together. Through the initiatives Denmark has taken a step forward to secure its position as a telemedicine pioneer country.

To sum up, Denmark has already come a long way in digitalizing the healthcare system, and there is still a common understanding among policy makers, clinicians and patients that digitalization of the healthcare system is the future. However, there are still some challenges in terms of interoperability between systems and looking specific into telemedicine it is challenging to generate valuable knowledge from innovative projects and the art of going from small-scale projects to nationwide large-scale project is just about to be tested out.

3 THEORY

Development and implementation of telemedicine applications for healthcare can be challenging. Although considerable efforts have been invested in trials and experiments of telemedicine services, only a few applications have continued beyond the initiative, research and development phase(10,25,26). This theory chapter emphasizes the importance of understanding and acknowledging the complexity of a socio-technical healthcare environment in order to achieve a successful innovative telemedicine project. Furthermore, the chapter will focus on the different approaches to generate knowledge from telemedicine projects and their appropriateness.

3.1 TELEMEDICINE – CONCEPTS AND DEFINITIONS

3.1.1 HISTORY OF TELEMEDICINE - IN BRIEF

Historically, telemedicine can be traced back to the late 19th century(27) with one of the first published accounts occurring in the early 20th century when electrocardiograph data were transmitted over telephone wires by the Dutch researcher and inventor of the electrocardiograph, Willem Einthoven(28). Modern telemedicine as we know it today started in the 1960s and has been facilitated on two different fronts. First, the technology advance of electronic methods of communication, where digital communication techniques started to replace the analogue methods. Secondly, the interest from the military and space technology sectors has been dominating in the development(27). Some of the first telemedicine milestones include the introduction of television to facilitate consultations between specialists at a psychiatric institute and general practitioners at a state mental hospital(29), and the provision of expert medical advice from a major teaching hospital to an airport medical center(30).

The dissemination of telemedicine is going faster than ever. The increasing availability and utilization of ICT by the general population have been the major drivers for telemedicine in the past decade, rapidly creating new possibilities for delivering health care(3). The rapid drop in cost of ICTs combined with improved digital infrastructures have accelerated the interest in telemedicine applications among healthcare-providers,

and have enabled healthcare organizations to envision and implement new and more efficient ways of delivering care(27). These advancements have created the foundation of the telemedicine applications, which will be developed and implemented in the future.

3.1.2 Concepts

Telemedicine applications can be divided into two basic categories, according to the timing of the information transmitted and the interaction between the partners involved - be it health professional-to-health professional or health professional-to-patient. The two categories are 'store-and-forward', or 'asynchronous', and 'real- time', or 'synchronous' telemedicine(3).

Store-and-forward (asynchronous) telemedicine involves the exchange of pre-recorded data between two or more individuals at different times. For example, the patient or referring health professional sends a picture or description of a medical case to an expert who later sends back an opinion regarding diagnosis and optimal treatment. Asynchronous telemedicine applications are often used in teledermatology(31). Real-time (synchronous) telemedicine requires the involved parties to be simultaneously present for direct exchange of information. Synchronous telemedicine applications are for example used in telepsychiatry, where video conferencing are used for consultations between patients and specialists, who are not situated at the same location(32). In both synchronous and asynchronous telemedicine, relevant information may be transmitted in a variety of medias, such as text, audio, video, or still images. These two basic approaches to telemedicine are applied to a wide array of services in diverse settings, including teledermatology, telepathology, and teleradiology(3).

3.1.3 Definitions

The term *'telemedicine'* derives from the Latin word *'medicus'* meaning *'healing'* and the Greek word *'tele'* meaning *'at a distance'.* The term telemedicine was first time used in the 1970s by the American Thomas Bird, who literally translated it to "*healing at a distance*"(28). The term telemedicine has been subject to a wide range of different definitions and today there are several terms describing more or less the same phenomenon such as, telecare, telehealth, e-health, medical informatics, m-health and telemedicine etc. A study performed by Sood *et al.*(33) found 104 study peer-review

definitions of the word. However, despite repeated discussions about what constitutes telemedicine, telecare and telehealth and what their differences are, all involve the transfer of information about health-related issues between one or more sites, so that the health of individuals and their communities can be performed(27). The definition adopted by the World Health Organization (WHO) in 1997 includes all aspects of healthcare including preventing healthcare. WHO defines telemedicine as:

"*The delivery of healthcare services, where distance is a critical factor, by healthcare professionals using information and communication technologies for the exchange of valid information and diagnosis, treatment and prevention of diseases and injuries, research and evaluation, and for the continuing education of healthcare providers, all in the interest of advancing health and communities*"(34).

The American Telemedicine Association (ATA) has historically considered telemedicine and telehealth to be interchangeable terms, encompassing a wide definition of remote healthcare. ATA defines telemedicine as:

"Telemedicine is the use of medical information exchanged from one site to another via electronic communications to improve a patient's clinical health status. Telemedicine includes a growing variety of applications and services using two-way video, email, smart phones, wireless tools and other forms of telecommunications technology" (35)

Some definitions, such as the definition given by WHO(34), include all aspects of healthcare including preventive care. In other cases the definition of telemedicine is limited to include the provision of clinical services only, with similar expressions such as telehealth, e-Health, and telemonitoring, being used to denote broader definitions of remote healthcare, not always involving active clinical treatments. This challenges the popular understanding of the telemedicine field, and requires researchers, healthcare workers and engineers working with telemedicine to be alert to other definitions and understandings of the subject among their collaborators and peers. The many definitions underscore that telemedicine is an open and constantly evolving science, as it incorporates new progressions in technology and responds and adapts to the changing healthcare needs and contexts of societies(3,36).

Some distinguish telemedicine/telemedical from telehealth with the former restricted to service delivery by physicians only, and the latter signifying services provided by health professionals in general, including nurses, pharmacists, and others. However, in this thesis telemedicine is recognized as a solution used by different healthcare professionals and between different sectors, telemedicine/telemedical and telehealth will therefore be seen as synonymous and will be used interchangeably.

3.2 Generating evidence from telemedicine

Evaluation of telemedicine applications is traditionally methodologically closely anchored to the general research tradition in the clinical world known as evidence-based medicine (EBM). EBM emphasizes the use of evidence from well-designed and well-conducted research studies to optimize healthcare decision-making(37). Whether applied to medical education, decisions about patient treatment, guidelines or administration of health services in general, EBM advocates that to the greatest extent possible, decisions and policies should be based on evidence, not just the beliefs of practitioners, experts or administrators. EBM classifies evidence by its epistemological strength and requires that only evidence gained from meta-analyses, systematic reviews and RCTs can yield strong recommendations, while weaker evidence such as from case-control studies can yield only weak recommendations(38). RCTs are seen as the gold standard of EBM in clinical research and imply carefully planned studies that introduce an intervention, a treatment or exposure to study its effect on patients(39).

Evidence is regarded as a requirement when creating medical guidelines for the introduction of a new drug or treatment. Similarly, evidence is needed to evaluate the advantages of telemedicine applications to society and to convince professionals and policy makers about implementation(40). In the formative years of telemedicine the majority of research efforts have focused on technology and feasibility evaluation, these kinds of studies were not sufficient for creating medical guidelines used for providing EBM(41). However, in the past decade there has been a significant increase in RCT studies, cost analysis and clinical outcome-focused telemedicine studies. According to Krupinski and Bernard, *"The existing body of telehealth evidence is now robust enough to create evidence-based guidelines and standards*"(41).

Creating evidence on clinical outcomes and cost-effectiveness is not straightforward when evaluating a telemedicine service and several literature reviews investigating effectiveness of telemedicine demonstrates lack of evidence(8,12). A systematic review identified 1300 papers examining telemedicine outcomes. The assessment showed that only 46 reported effect on clinical outcomes(42). This is supported by Ekeland *et al.* (8) who carried out a systematic literature review of reviews on impacts of telemedicine services with the purpose of identifying the 'state of the art' and the quality of the reviews. 80 systematic reviews were reviewed and the research group(8) concluded,

"Despite the large number of studies and systematic reviews on effect of telemedicine, high quality evidence to inform policy decisions on how best to use telemedicine in health care is still lacking".

Ekeland *et al.*(8) furthermore underscore, *"As the field is rapidly evolving, different kinds of knowledge are also in demand, e.g. a stronger focus on economic analyses of telemedicine, on patient's perspective and on the understanding of telemedicine as complex development processes, and effectiveness and outcome as ongoing collaborative achievements".*

Another review of systematic reviews likewise conducted by Ekeland *et al*. (43) summarize the methodologies used for assessing telemedicine, discusses identified knowledge gaps and makes recommendation of methodological approaches for further telemedicine research. They assessed nearly 1600 papers from which they found 50 describing the method used. Based on their analysis they made four recommendations for the development of a stronger evidence base for telemedicine. To improve telemedicine research they call for I) large, rigorous design-control studies that assess the impact of telemedicine; II) standardization of intervention, population and outcome measure to reduce heterogeneity and to produce the possibility for generalizing evidence and facilitate meta-analysis; III) combination of quantitative and qualitative methods; and IV) more naturalistic methods and settings. However, Ekeland *et al*. (43) emphasize, when evaluating telemedicine applications the possibility to create measurable and generalizable evidence is challenging. This is due to the complexity and experimental and temporal aspects of service combined with the collaboration and

communication capacities of the technology, which are key factors influencing the telemedicine effects. Even though the review carried out by Ekeland *et al.*(43) call for more rigorous design-control studies the reality is that only few telemedicine applications have reached the state where they are ready for being evaluated in a rigorous study design as RCTs. In a paper from 1999, Berg(10) states that as much as 75% of all telemedicine initiatives should be considered as operating failures. More contemporary papers support this picture of telemedicine implementation. Zanaboni *et al.*(25) express that the adoption of telemedicine in routine healthcare has been slow, uneven and fragmented. Moreover, MacFarlane *et al.*(26) support this by arguing, "*Internationally, however, telemedicine has a poor record of implementation and sustainability. The field is characterized by small-scale demonstration or experimental projects".*

These perspectives underscore the challenges met when trying to generate evidence from telemedicine projects and the importance of recognizing that when a telemedicine solution is unstable or immature both in terms of technological and organizational perspectives, methodologies for evaluation should be reconsidered. If the solution is not ready to be evaluated in a rigorous study design it is instead important to address telemedicine interventions and achievements as complex and ongoing innovations in natural settings, helping to learn from the success and failures so that the same wheel is not re-invented each and every time(43). To generate valuable knowledge from a telemedicine project it is therefore important to choose an evaluation approach, which reflects the design and implementation context.

3.2.1 Evaluation approaches

Based on the previous section, it is evident that telemedicine evaluation is heavily positioned in a positivistic, and naturalistic approach. The positivist tradition stresses that the only authentic knowledge is that based on sense, experience and positive verification. Summative assessments, such as clinical trails and other controlled effect studies are derived from positivism(43). In a positivistic view telemedicine is seen as well defined, preferably as singular objects of study or interventions, and predefined outcomes. Controlled trials, preferably RCTs are applied to obtain evidence where the predefined outcomes are fixed and can be measured and analyzed by applying

quantitative methods(39). RCT studies on the effectiveness of telemedicine are acknowledge as essential for decisions makers, to make decisions about whether the technology should be used or not. However, the evidence of effectiveness of telemedicine is fragmented and incomplete(8).

Even though RCTs are recognized as the golden standard for providing high quality evidence and are used as the main evaluating approach in many studies, there still are some disagreements about whether this approach is appropriated for evaluating telemedicine studies(41,44). To create evidence on effectiveness, carrying out a RCT study when evaluating a telemedicine application is no easy task. The rapidly developing of technology is limiting a static setup and long-term evaluations and combined with the identified difficulty in obtaining a valid control group does not correlate with a RCT study design. Due to the time-consuming aspects of conducting RCTs it is often argued that rigorous evaluation studies are done just as the technology becomes obsolete(41). Stoop *et al.*(45) discuss*, "Generating these kind of 'objective' circumstances is impossible and unwanted in practice because of the peculiarities (routines, prodeciders, preferences) of professionals and departments within and between hospitals".* Kairy *et al.*(9) further argue, *"In order to develop an evidence base that is useful for decision-making, it is essential to pursue research that gives us a better understanding of the underlying processes when they are implemented in a real context."* Ekeland *et al.*(43) support this argument in a research study where they reviewed the methodologies used for assessing telemedicine, in the study it is concluded that controlled studies cannot address all emerging questions and they recommend, *"Assessments of telemedicine as complex interventions and with mixed methodological approaches considering outcome as partly contingent on values and contexts".* This is underscoring that conducting evaluation of telemedicine application is no easy task.

As opposed to the positivistic tradition are the traditions of naturalistic, which view telemedicine as heterogeneous, multiple and as developing in interaction with different stakeholders(43). In a naturalistic research approach qualitative methodologies are applied. The qualitative paradigm aims to gather an in-depth understanding aiming at generating an understanding of the context of the ICT system, and the process whereby the system influences and is influenced by its context(46). Qualitative methods can be

applied by preforming interpretive research, which has a great potential to produce an insight into how ICT systems are developed and used. Popay(47) argues, *"Evidence derived from qualitative research has an important contribution to evaluation of the more complex picture".*

Considered the large number of telemedicine projects not surviving the research phase (25,26,48) , alternative evaluation approaches are still needed in order to gather knowledge from projects, which are not ready for rigorous evaluation studies. When having an unstable and immature telemedicine solution a qualitative evaluation can contribute with valuable knowledge concerning a deeper understanding of the challenges related to telemedicine development projects and the socio-technical circumstances, which influences and affects the establishment of a telemedicine application.

3.3 CHALLENGES RELATED TO INNOVATIVE TELEMEDICINE PROJECTS

To understand the challenges related to innovative telemedicine projects, it is essential to explore the nature of the interplay between technology and humans. It is widely acknowledged that telemedicine can be an improvement to future healthcare delivery by holding great potential for reducing the variability of diagnoses as well as improving clinical management and delivery of healthcare services worldwide by enhancing access, quality, efficiency, and cost-effectiveness(3). According to Broens *et al.* (40) there are two major developments, which are influencing the way healthcare will be provided in the future.

"The first development is the growing number of elderly people with chronic disorders and the decreasing number of healthcare professionals. The second development is the increased quality of information that patients have at their disposal, which is likely to change health care to a demand driven process, tailored to the needs of the patient" (40)

The fast development of new technology initiates the tendency that patients can access quality information regarding their own treatment and combined with the increasing public acceptance of technology are factors tailored for providing the foundation for development, implementation and use of telemedicine services.

However, despite the increasing acceptance of technology in society and political support, most telemedicine projects do experience huge challenges and do not survive the research stage reaching large-scale deployment and wide adoption(10,25,48,49). Zanaboni *et al.*(25) express, "*While successful telemedicine applications certainly exist, they are generally still run by local telemedicine champions and funded on an ad hoc basis. Almost no telemedicine applications have succeeded in reaching large-scale, enterprise-wide adoption".* One of the main reasons leading to these failures is the insufficient knowledge and understanding of the interplay between organizations and technology and how and why individuals and organizations adopt the technology(49).

An important topic in much recent work has been the problem of 'resistance' among professionals and the assumption that their 'attitudes' to telemedicine are the main problem(48). May *et al.*(50) theorize the understanding of implementing complex interventions in healthcare by applying a normalization process model. They assume that technologies which are understood by the users to a greater extent have a more positive impact on; inter-professional relationship, healthcare delivery, and which fit well with existing work practices and organizational context are more likely to normalize and be adopted than those with negative impact or poor fit. This assumption fits well with the general picture of what determine successful telemedicine, which is reflected in several studies there have been conducted in order to identify determinants of successful telemedicine implementation(2,10,12,40,51). In the following section identified determinants of successful telemedicine will be elaborated.

3.3.1 Determinants of successful telemedicine

When approaching telemedicine, success is a relative term and cannot be seen as an absolute attribute(25). This reflects that many factors are associated with successful telemedicine services, and there is no straightforward answer on how to make a successful implementation. Based on two studies(2,12), which I find representative, the key factors that influence the outcome when performing a telemedicine intervention will be highlighted.

Joseph *et al.*(12) conducted a literature review on 13 organizations surveyed in England in order to identify key challenges in the implementation of telehealth. The authors discovered seven key challenges: I) *Staff*, where it among other things was considered

crucial to recruit clinical champions and to generate interest among decision makers. II) *Project management,* it was identified that a dedicated project manager was important in the implementation process, and the amount of time carried out on the implementation was often underestimated. III) *Patient and provision of support,* it is important to identify the right patients and to give the patients regular feedback when monitoring their conditions. IV) *Technology,* often technical problems occur during the implementation, which need to be adjusted for. Moreover, maintenance of equipment needs to be considered as part of the project implementation. V) *Partnership working,* to achieve successful implementation it is a key factor to engage the local authority. VI) *Funding,* most projects were only supported by project based funding, which is considered a limitation in successful implementation. VII) *Strategic plan,* none of the organizations surveyed had a long-term plan reaching further than the limited project period.

The identified challenges were used to develop a model and a checklist for telehealth. The model consisted of five components: I) Identifying and clearly describing issues, needs and partners are essential, and evidence of effectiveness must be considered in relation to the conditions in question and telehealth. II) Producing a strategy to enter ilia ensure all key priorities for change has been identified and to consider ethical, safety and staff related issues. III) Securing funding. IV) Implementing changes in service delivery including among other things consideration about choice of supplier, training of staff and identification of clinical champions. V) Monitoring and evaluation are important in order to measure the outcomes of the intervention and to disseminate the results achieved in the project. The five components were then followed by a list of questions to be considered during the development and implementation phase of the projects. The authors emphasize that the checklist approach needs to be considered with caution, and must be seen as a guideline instead of a definitive answer on how a project will achieve success, due to the importance of seeing telehealth projects as projects involving complex and multifaceted interventions.

In contrast to Joseph *et al.*(12), Obstfelder *et al.*(2) carried out a literature review with the aim to determine characteristics of successfully implemented telemedicine applications. They performed a systematic literature search in relevant databases,

however they only managed to find 16 studies of telemedicine applications in clinical use. They found certain general characteristics of these successfully implemented telemedicine applications, which they describe in terms of six main categories. I) An effort is made to describe the local health-related challenges that the technology is intended to solve. II) A telemedical application is seen as a potential solution to the challenge. III) Equal access to healthcare is often a major concern, justifying the implementation of telemedicine. IV) Successful implementation depends on teamwork, involving the initiators of the technology as well as the managers, clinicians and patients. V) Successful implementation is often characterized by a sound anchoring in established organizations and technical structures, or by the establishment of new structures, finally VI) Plans for future use and for future financing are important to success. The authors discuss that the implementation of telemedicine is not simple, and the success of implementing telemedicine applications into practice, largely depend on how the identified factors are approached. They also point out that new technologies alone do not create change, and technology must not be seen as static entities moving from intervention through diffusion and into routine. Instead it must be seen as interplay between technical and social factors that produce certain outcomes, entailing the need for more research-based knowledge about the reciprocal adaption process between technology and clinical challenges.

Comparing the two approaches performed by Joseph *et al.*(12) and Obstfelder *et al.* (2) it is clear that if one is able to identify and overcome the key challenges that are characteristic for the development and implementation of telemedicine applications, it will increase the likelihood to achieve a success. Identifying critical factors before implementing telemedicine are definitely important. However, it is discussed in the papers that several of issues are to be considered when implementing telemedicine and there is no clear answer on how to achieve a successful implementation. This underscores that one thing is to identify the key factors related to successful implementation, but the true challenge arise when one have to overcome these identified factors. Successful implementation of telemedicine applications therefore entails handling a multi-faceted complexity, taking place in a socio-technical heterogenic healthcare environment. In the next section it will be elaborated how to see

information systems in a socio-technical perspective in order to get a deeper understanding of the processes which frame innovative telemedicine projects.

3.4 Information systems in a socio-technical perspective

Telemedicine is a new way of practicing medicine, and to understand the critical aspects of developing and implementing telemedicine applications, it is essential to pay closely attention to the relationship between technology, work context and the structuration of organizational activities to get a deeper understanding of the underlying processes(51). When introducing new technology or adjusting already implemented technology in a healthcare setting, technology and humans are tightly interwoven, aligned towards the achievement of common tasks(10). A socio-technical approach can be applied to assess the issues related to development and implementation of ICT in organizations and has been developed in response to challenge the understanding of complex technical systems that are imbedded in a human world(52). A socio-technical approach emphasizes the importance to look at the interrelated elements that constitute the adoption of new technology as a whole, rather than as a technical subpart and a social subpart.

3.4.1 The complexity of technology in healthcare work practices

In a socio-technical approach, clinical work practices must be seen as heterogeneous networks of people, organizational routines, tools, documents and so on(10). Clinical work practices may differ in time and place, and can take place in either the municipality, at the hospital, in general practices or as an intersectoral work practice. Common to all clinical work practices are that they can be seen as an interconnected gathering of humans and things whose functioning are mostly to deliver patient care (10) . To ensure the best possible treatment of patients, clinical work is build upon 'best practice' routines. These 'best practice' routines are often described in manuals and procedures serving as instructions for novice as well as for experienced healthcare workers(10,53). Although, healthcare practices often entail considerable uncertainty about diagnosis and on how to treat the patient. The elements creating the heterogeneous network that frames the clinical work practice become essential, for healthcare workers to understand the patient's condition and to discuss information and impressions with each others(54).

Heterogeneous healthcare networks include several of essential 'elements' in order to be running in a complex and smooth manner. However, if one pulls away one of these elements, the work practices could not continue functioning in its current way(55). Many different professions are employed in the healthcare sector and the roles and tasks of the healthcare workers are tightly interwoven with each other and with the essential elements constituting the work practices. Berg(10) elaborates on this by saying,

"A 'physician' is only a 'physician' in the modern western sense because of the network of which s/he is a part, and which makes his/her work and responsibility a reality. Without nurses, record systems or the stethoscope, the medical doctor as we know it would and could not exist".

Because of the tightly interwoven relationship between the elements in medical work practices, the introduction of a new element, such as a telemedicine application, often will echo throughout the whole heterogeneous network which frames the clinical work practice. Thus, the adoption of a new ICT system can be seen as an involved socio-technical process of negotiation, and the implementation or adjustment of an ICT system will often affect and involve the whole organization, across different actors including non-technical and technical actors(56). A socio-technical approach underscores that through insight into the work practices in which an ICT application will be used should be the starting point for design and implementation of ICT applications.

3.4.2 Designing and implementing new ICT for a complex healthcare organization

In many ICT projects in healthcare it is often experienced a large gap between expectations and results. This stresses that one should not only focus on the technical or clinical characteristics of the implementation, but a more nuanced approach is needed to acknowledge the complexity of the heterogeneous healthcare environment.

As earlier mentioned, many telemedicine projects do experience huge challenges and do not make it out of the research phase, because they are facing the challenges to cope with the technical and social issues arising when introducing new technology into a

healthcare setting(10,25,26,48). This emphasizes the importance to look more closely into the processes of developing and implementing new ICT for a complex healthcare organization. When designing new ICT solutions for healthcare, interdisciplinary collaboration is required. However, the collaboration can be challenged by misunderstandings due to different background of the participants in the project. Kaplan *et al.*(57) explain,

"Healthcare requires collaboration, as does system implementation, yet there is difficulty in translating among specialties, stakeholders, clinicians, and implementers, sometimes to the point of a seeming 'culture clash'".

The difficulties in creating a common understanding between the various groups involved in the design process of an ICT solution may be reflected in the creation of requirements. Different participants might see the technology as a way to achieve their potential contradictory goals(10). The requirements may not satisfy the need of all the involved people in the organization, or the involved people may not know how to communicate their needs. This implies that technology, consequently, result in that all participants do not share values and assumptions. Kaplan *et al.*(57) further explain,

"Some projects are undertaken for reasons other than need for the project: because requirements come down from the top, or because the project was simple to do, or because developers like the people who want the project".

The people involved in the design process, developers, IT-architects, project managers and so forth draw on their previous experiences when developing new technology. The designers make assumptions about what competencies are required by the system as well as the users. Nicolini(51) expresses, "*A large part of the designers work is that of inscribing a vision of (or prediction about) the world in the technical content of the new object."*

The vision and the assumptions, which are inscribed into the technology, only comes to life when the technology are put into context of daily life. The technology will then interact with exciting work practices of the users, and expectations and restrictions of

the future use will be visible. The result of this interaction will be a process of negotiation between the new technology and the existing work practices(51). However, the expectations to the technology do not always correlate with what users actual need due to the difficulty of understanding the context which it is used in. It can be difficult to fully understand the healthcare workflows as evidenced by workflows changes may result in endless workarounds(57). Therefore a deeper understanding of what actual goes on in the healthcare workflows is needed, and it is important to acknowledge, as emphasized by Berg *et al.* (58), *"An important rationale of implementing these systems is that they change pre-existing work practices".*

Generating new knowledge from telemedicine projects is essential to provide improved healthcare and to enhance future development of telemedicine solutions. A well-conducted evaluation is therefore important on one hand with respect to contribute to thorough evidence for use by decision-makers, and on the other hand to learn from the success and failures of previous projects.

3.5 Evaluation of telemedicine in a socio-technical perspective

Telemedicine research is placed in the intersection between the technological, medical and organizational/social research communities. The interdisciplinary research field is reflected in the differences of topics researched, and what the researchers priorities as important outcomes, which often result in fragmented research where the different aspects are evaluated separately(43). When evaluating ICT in healthcare, telemedicine included, many decisions have to be made, decisions about why to evaluate, what to evaluate and when to evaluate(45). When one has answered these questions, it is time to clarify how the evaluation should be performed. There are various evaluation methods which all have their advantages and disadvantages. However, choosing the right evaluation method can be challenging as expressed by Stoop *et al.*(45),

"*Given the multitude of potential questions and priorities of different stakeholders, it is impossible to give a blueprint of how to proceed in designing an evaluation and selecting the proper method".*

When evaluating information and communication technology it is often impossible to disentangle the 'effect' caused by the new technology itself from the 'effect' caused by the changes in the work practices introduced by the implementation of the new technology(45). It is therefore important to see the technology in the light of a socio-technical perspective, where it is essential to look at both the technology and the actors using the technology. As mentioned earlier both qualitative and quantitative research approaches have their limitation when used for evaluation of ICT applications. This leads to several studies applying a mixed method combining qualitative and quantitative research approaches(43,59). Stoop and Berg(45) argue, *"One of the reasons for the importance of 'multimethods research' is that the use of different methods is needed to capture the diverse and diffuse nature of information systems' effects".*

The choice of evaluation approach applied may also reflect the question one seeks to answer. If the technology is under development, it may not be appropriated to use controlled trails, as the technology and the surrounding organization has not reached a steady state and will still be modified and influenced. On the other hand if one seeks to investigate the clinical effect of a well-tested telemedicine intervention, a controlled trail may be appropriated. The many different research approaches have resulted in the quality of telemedicine studies has been questioned and it is debated, which research methodologies and techniques there are appropriated to apply for telemedicine evaluation. As a response to this debate concerning the discussion that few existing studies are well-designed have resulted in the development of a common evaluation template, which tries to combine the different research approaches recognizing the importance of including a socio-technical perspective(60).

3.5.1 Model for assessment of telemedicine

With support from the European Commission, a Model for Assessment of Telemedicine (MAST) was created in 2012 in order to provide a guideline for consistent assessment of the outcomes of telemedicine(60). The model attempts to incorporate a socio-technical perspective by including a multi-disciplinary perspective in the evaluation model. The assessment consists of 3 elements, which are illustrated in Figure 1. First step is to make preceding considerations to determine whether it is relevant or not to carry out the assessment. Next, the different outcomes of the telemedicine application is

described and assessed through a multidisciplinary assessment in relation to seven predefined domains. Finally, an assessment of the transferability of the results should be made.

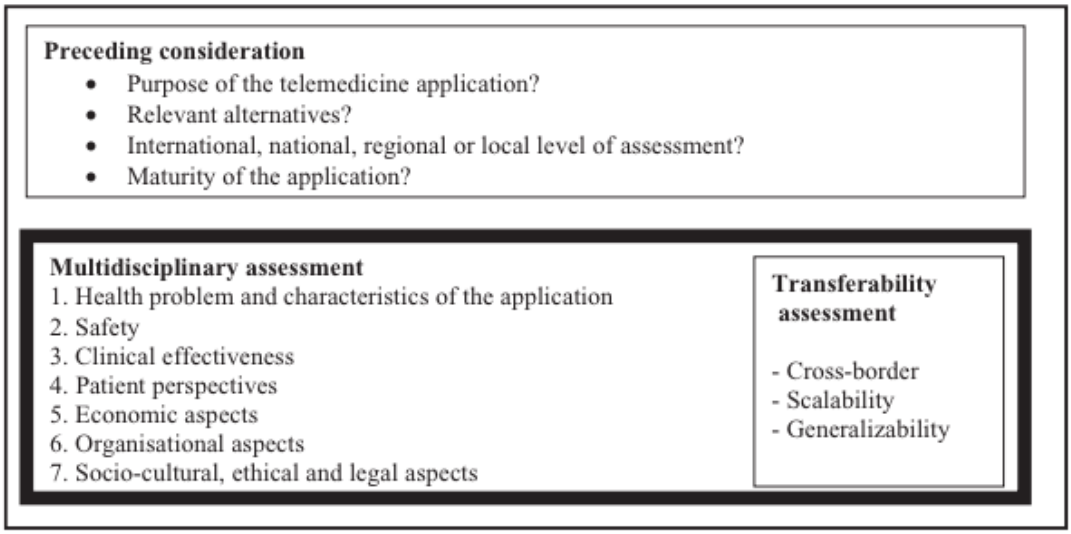

Figure 1: The elements in MAST (60)

The model is an attempt to describe effectiveness and the contribution to quality care of a telemedicine application, and to produce a basis for decision-making. The authors (60) encourage, *"Reporting of results should also follow general guidelines for reporting health research such as guidelines for reporting RCTs and economic evaluation*".

However, the MAST guideline also has its limitations, Kidholm *et al.*(60) point out that in order to follow the guideline it is important to consider the maturity and development over time of the telemedicine application. Drummond *et al.*(61) argue that an evaluation based on a RCT can be challenging and problematic, if the development of the telemedicine application is not in a substantial 'steady-state' period. This leads to Kidholm *et al.*(60) saying, that it is important to determine whether the telemedicine application is mature or not before initiating an assessment of the outcomes and the telemedicine application must has been used on a sufficiently large number of patients, for most problems to be addressed.

Even though a socio-technical perspective has been included in the MAST evaluation, the model is considered insufficient if the technology is still under development and has not reached a steady state. Alternative evaluation approaches are therefore sought

after. One approach to generate knowledge from ICT development projects could be to carry out a process analysis to look closer to the socio-technical changes occurring during an ICT implementation process.

3.5.2 PROCESS ANALYSIS

The traditionally perception of ICT development is increasingly being challenged by perspectives that advocates a more contingent and situated dimension to the ICT development process. This has inspired McLeod and Doolin(62) to present an approach to researching IS development through qualitative methods. The research approach attempts to facilitate understanding and explanation of the complex and multi-dimensional phenomenon by using a process perspective. Process analysis involving qualitative research methods is concerned with creating knowledge of how and why particular outcomes in a change process develop over time. McLeod and Doolin (62) elaborate, *"Outcomes are analyzed as the consequence of sequence of interrelated and interdepended events or instances of social action in organizational processes".*

In their approach to process analysis they draw on theories of situated action and socio-technical change to produce a narrative explanation of information system (IS) development. The narrative approach to process analysis and how they theorize data by seeing IS development, as situated socio-technical change will be elaborated in the following subsections.

3.5.2.1 A NARRATIVE APPROACH TO PROCESS ANALYSIS

McLeod and Doolin(62) apply an approach to process analysis, which is grounded in research traditions that views processes as a fundamental characteristic of organizations. They explain(62),

"*The aim is to develop an analysis that investigates multiple and interconnected levels of context, reveals the temporal interconnectedness of phenomena, examines the reciprocal relationship between context and action, acknowledges the pluralistic nature of organizational participants' interpretations, and recognizes that explanations of change are likely to be holistic and multifaceted, rather than linear and singular*"

In order to investigate the multiple and interconnected levels of context detailed process narratives are produced from the rich data collected in a case study(62). Previous literature have stressed that narrative analysis is a useful way to tell the story of a complex set of events(63). To explore in greater details, which changes occurred and to generate knowledge used for the process analysis, narratives can be a useful strategy because they incorporate time as an organizing device. Process researchers use narratives to explain the observed data, ranging from chronological descriptions of connected events to the more substantial role(64). Pentland(64) argues, *"In the domain of process theory stories are constructed. More precisely, stories help explain the relationships between events in a process or a narrative".*

Pentland(64) and Webb and Mallon(63) note that narratives provide a middle ground which tries to make a tradeoff between maintaining the richness in describing socio-technical systems and also the need to provide generalizations at the same time. Pentland(64) furthermore emphasizes the importance of, *"Pay attention to all aspects of narrative—not just sequence. Although event sequence data are central to process, they are insufficient to tell a whole story".* Moreover, McLeod and Doolin(62) argue, *"In producing process narratives, it is important to avoid treating description as an end in itself. Meaningful explanations of process outcomes require more than the description of event sequences – a case study, rather than a case history".*

To add value to the case narratives and to identify the generative structures that shape the process, is needed a theoretical understanding that enables knowledge and interpretation of the process(64). McLeod and Doolin(62) describe, *"Some theoretical apparatus is needed with which to articulate how and why a particular process outcome emerges".* In the process analysis presented by McLeod and Doolin they theorize IS development as situated socio-technical change.

3.5.2.2 ICT DEVELOPMENT AS SITUATED SOCIO-TECHNICAL CHANGE

Addressing the change associated with developing and implementation of new ICT into an organizational context is multifaceted. To enlarge the vocabulary for describing the underlying processes McLeod and Doolin(62) conceptualize IS development as, *"A dynamic, multi-dimensional process, in which a development outcome emerges*

unpredictably from complex and reciprocal interactions between people and technology within an organizational context". To their conceptualization they adopt the assumption that IS development is both situated and socio-technical.

A situated action perspective on ICT development emphasizes the interrelationship between ICT development activities and its contextual setting, which it is both interrelated with and inseparable from(62). Situated actions stress actors' ability to process knowledge and how they use common-sense procedures/practices to produce, analyze and make sense of one another's actions and their local or situated circumstances. Overall people's actions are influenced by the context of their specific situation. Orlikowski(65) applies the notion of situated change to theorize technology-based organizational transformation and she views organizational transformation *"as situated change grounded in assumptions of action, not stability"*(65). Moreover Suchman (66) suggests, "*Every course of action depends in essential ways on its material and social circumstances*". Actors or participants in an ICT development project therefore use their pre understanding routinely and reflexively to monitor their own and others actions while monitoring social and material aspects of the specific setting in which the (inter) action occurs(67). By conceptualizing ICT development as situated underscores seeing ICT development as an ongoing process, which can never be seen as a process of simply installing and using a new technology(10).

ICT development viewed in a socio-technical perspective attempts to overcome the limitations to see change as either technical or social by stressing the importance to address both aspects and the reciprocal interrelationship between them(62). To describe the generative outcomes and mechanisms associated with IS change the socio-technical components and their connections can, according to Lyytinen and Newman (68) be *"regarded as the general lexicon"*. Originally, Leavitt's(69) socio-technical model (Figure 2) synthesized the base of theories of organizational change and viewed organizational systems as multivariate systems of four interacting and aligned components – *actors, tasks, structure and technology*. Translating the four components into dimensions of ICT development, *actors* are the stakeholders and project participants including their characteristics and attributes; *tasks,* refers to how and what the required development tasks are accomplished, including the projects goals,

outcomes and resources; *structures,* represent the organizational rules and arrangements that shape the actors' behavior; and finally, *technology* includes development tools, software and hardware used in the IS development process(70).

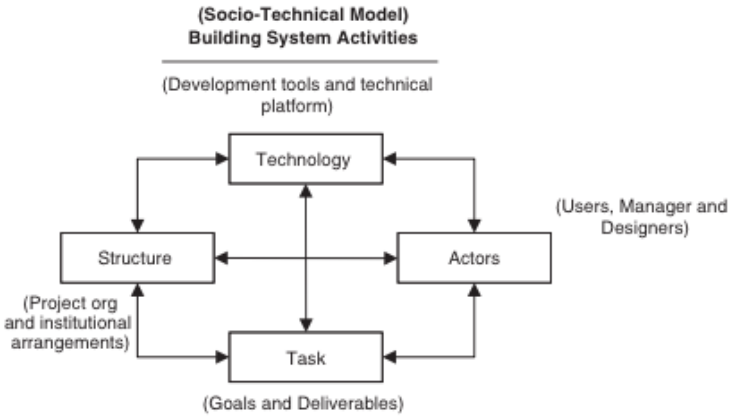

Figure 2: Socio-technical model of a building system

McLeod and Doolin(62) present, inspired by Leavitt's socio-technical model, a conceptual model (Figure 3) of IS development, which can be used to inform a process analysis. According to McLeod and Doolin(62) "*The model synthesizes our understanding of IS development as an emergent process of situated actions*". The conceptual model is an attempt to produce a meaningful explanation of process outcomes by forcing process narratives to go beyond being just descriptive. The focus of the model is on the *situated actions* that constitutes IS development. McLeod and Doolin(62) suggest, "*That IS development processes provide both opportunities and sites for situated action and interaction among the internal and external actors involved in IS development".* The fact that processes and activities characteristically associated with IS development range from defining the requirements to the change management associated with the implementation, explain why *situated action* is placed at the heart of the model to reflect its central role in the IS development process. Furthermore, the model incorporates Leavitt's(69) four components of a socio-technical system to describe the interrelated and complementary dimensions of situated actions where change in one component leads to organizational change through influences on one or more of the other components.

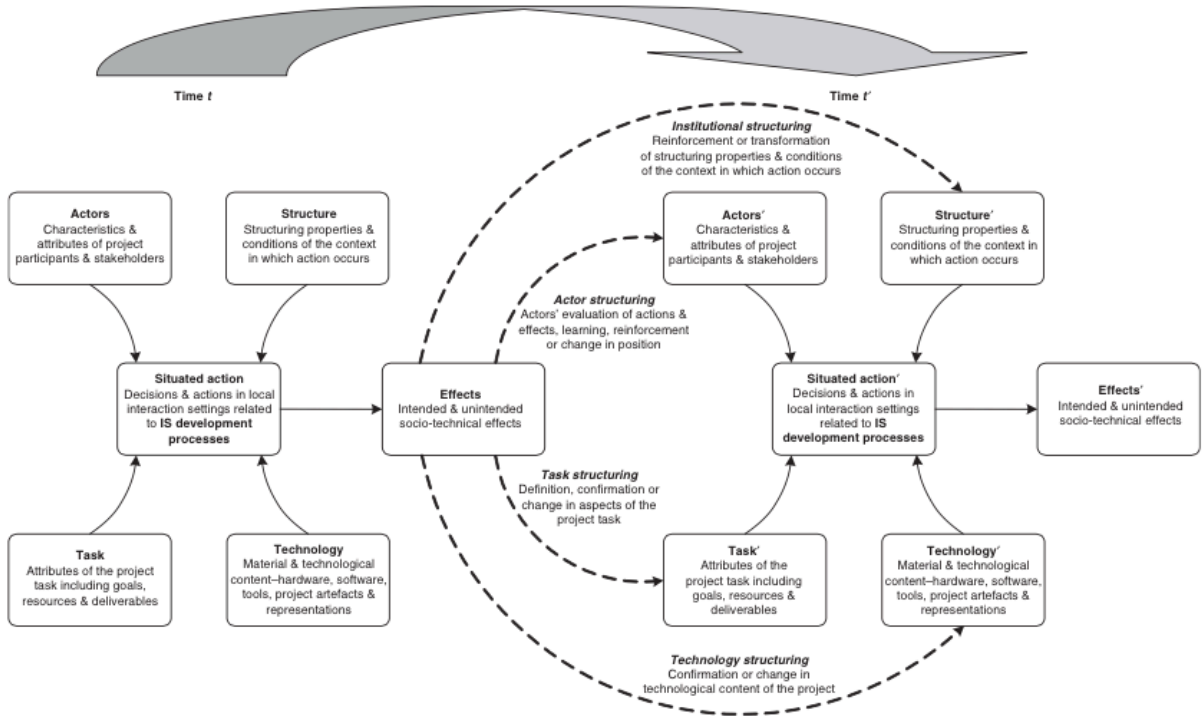

Figure 3: A conceptual model of IS development as situated socio-technical change.

In the conceptual model (Figure 3) the four components are separated for analytical convenience, in practice "*they constitute a mutually interactive, complex socio-technical ensemble*"(62). The arrows used in the model to connect the components with the central area indicate that the components are included within the central field of socio-technical actions, and are not intended to represent deterministic or mechanistic causality. To provide a richer vocabulary for the process analysis the four components can be extended with a theoretical anchoring in a situated and socio-technical perspective. First, IS development often take place in a temporary and cross-disciplinary project-based setting, including different participants who all engage in processes of communication, negotiations and sense-making in order to generate meaning in relation to the IS solution. The actors act within defined relationships and roles and the actors' sense making, decisions and actions are influenced by their knowledge, skills, expectations, believes and values(62). Second, the actors' actions and decisions are derived by the project tasks and how the actors interpret the action related to aspects of the given task, such as project scope and goals, complexity and available resources(68). Third the immediate organizational context and the socio-economic environment the organization is located in provide the structures which influence how actors act and interact. In this way IS development is shaped by formal

and informal organizational structures of "*relations and authority, institutionalized norms and rules that constitute organizational culture, established organizational polices and practices, or industry, market and regulatory conditions*"(71). Fourth, in IS development actions and decisions are influenced by the practical demands of the technology in question.

Another aspect of the conceptual model (Figure 3) is the intended and unintended *effect* that situated action has on material and non-material domains. These effects have the potential to influence and shape the structuring of future situated actions (*actors, tasks, structure and technology*)(62). This structuring is illustrated in Figure 3 as four feedback loops between the effects of situated action and the influence on a future moment. McLeod and Doolin (62) emphasize, "*Actor, task and technology structuring are envisaged as operating within the timescale of an IS development project, although some structuring effects may have longer-term implications."*

I find the approach presented by McLeod and Doolin (62) highly appropriated for the evaluation for the telemedicine part used in the ACCESS-project, in order to investigate the interrelationship of the four socio-technical components and the influences and effects affecting the underlying processes of the development and implementation phases in the project. The theoretical frame presented in this chapter will be used in the discussion to theorize the findings collected based on the ACCESS-project.

4 RESEARCH SETTING

In this chapter an introduction to the ACCESS-project (Acure Combined CarE for Seniors in South Jutland) will made. The aim of the chapter is to found the base for one to understand the context of which the empirical findings are conducted within.

4.1 THE ACCESS-PROJECT

The ACCESS-project is a research-project established as a joint project between the Hospital of Southern Jutland, GP's located in the hospital's admission area and the four municipalities: Haderslev, Aabenraa, Tønder and Sønderborg(72). The aim of the project was to evaluate various cross-sectorial collaboration forms with a focus on people over age 65 with acute medical illness requiring immediate increased healthcare activities.

The project originated from a bulletin from the Danish Health and Medicines Authority, with a desire to strengthen collaboration on subacute/acute offers for the elderly medical patient. The Danish Health and Medicines Authority approved and founded the project(73). The project was supported by, the local coordination forum for the hospital of Southern Jutland's admission area (SOF I SYD), which included among others representative from the health directors from the four municipalities, representatives from general practitioners and the hospital director. SOF I SYD has served as steering committee for the project, and has paved the way for establishing the organizational measures that are fundamental to the creation of new forms of cooperation.

The project objectives were to evaluate, I) How many medically ill elderly will use an acute municipal care offer as an alternative to hospitalization, and what are their characteristics? II) Is there a difference if a medical specialist at the hospital is responsible for the examination and treatment instead of the GP? III) Is there a difference between treatments at an acute unit in a municipal care center and home treatment from an acute team? IV) Is technology the solution for this group of patients, and V) What experiences can we gather from the development and implementation of the specific interventions in ACCESS-project?

The project was carried out in the period from 11.1.2013 until 3.1.2015. The project was designed as a RCT (Figure 4). In the RCT the primary outcome was the number of admissions within 7 days, depending on whether a medical specialist (the intervention) or the GP was responsible for the treatment. Simultaneously, mortality, mental and physical changes as well as the satisfaction of the patients and relatives were registered as secondary outcomes. The collected data were also used to assess the impact of treatment from municipal acute units or acute team on the same outcomes. The process of development and implementation of specific interventions in the ACCESS-project was analyzed qualitatively using a program theoretical analysis. The project was furthermore evaluated with the respect to the use of the telemedicine solutions; the evaluation of the telemedicine solutions has founded the basis for this master thesis. The other elements subject to evaluation will not be addressed in this thesis. But can be accessed in the evaluation report for the project(13).

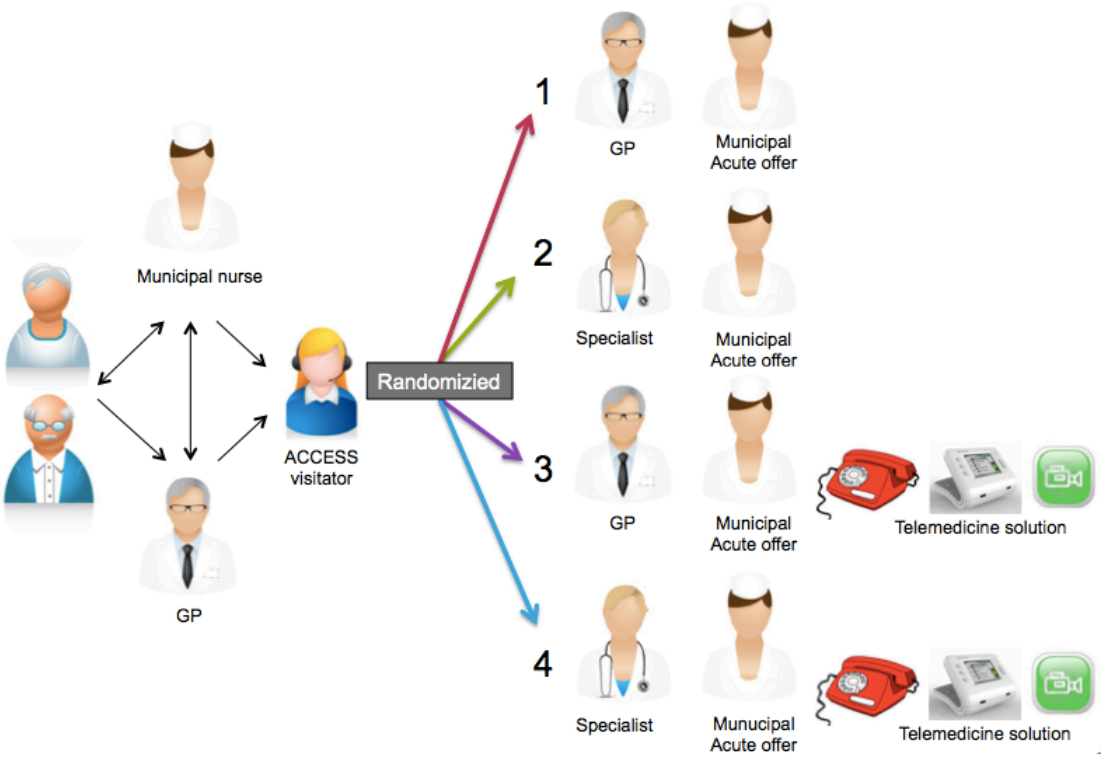

Figure 4: RCT design for ACCESS-project

The acute offers in the municipalities consisted of special trained acute teams treating the patients either in the patients' own homes or at an acute unit in a care center. Two municipalities (Haderslev and Sønderborg) offered treatment at home and two municipalities (Aabenraa and Tønder) had established special acute units in care centers. In group 3 and 4 (Figure 4) access to a telemedicine solution was added to the

established acute offers (group 1 and 2 (Figure 4)). The telemedicine solution consisted of three elements: I) Medical devices to measure blood pressure, heart rate and oxygen saturation. The data collected were available in a shared online portal, II) Live video communication between the nurse in the municipal acute offers and the medical specialist at the hospital, III) A hotline that made it possible for the nurses in the acute teams to contact the specialists in the hospital and to hospitalize patients around the clock.

At the establishment of the project the sample size was calculated to 111 participants in each group, 844 in total(72). This led to a calculated inclusion of 222 patients in the study period, where the telemedicine solution would be used as a part of the treatment. However, half way in the inclusion period it was recognized that the project was challenged by fewer inclusions that expected and that it was not appropriated to evaluate the telemedicine intervention in a RCT study. The evaluation of the telemedicine intervention was therefore instead evaluated through a qualitative approach. The sample size was therefore recalculated to 88 participants in each group, 328 in total.

4.2 THE TELEMEDICINE SOLUTIONS

This section describes the elements that constituted the telemedicine solution available in ACCESS-project.

4.2.1 MEASURING AND SHARING VITAL VALUES

The setup for telemonitoring is illustrated in Figure 5 and consisted of equipment for measuring vital values including a HUB, which had a 3G modem, and a Bluetooth dongle plugged in to collect the vital values measured by the blood pressure and saturation devices. The specifications for the telemedicine devices can be found in Table 1. The measurements were supposed to be uploaded automatically to an online portal and could be accessed by all relevant healthcare workers both in the municipalities and at the hospitals. The measurements were intended to be able to be made both by the patients themself and by the healthcare professionals. A Danish IT-company, Systematic, delivered both the medical devices and the shared platform for sharing the vital values.

Components
Numera HUB incl. Dongle with TDC-SIM card
Bluetooth dongle: ASUS USB 211
Blood pressure device (Bluetooth) A&D UA 767 PBT-C40
Pulse oximeter (Bluetooth) Onxy II9560

Table 1: Components included in telemonitoring

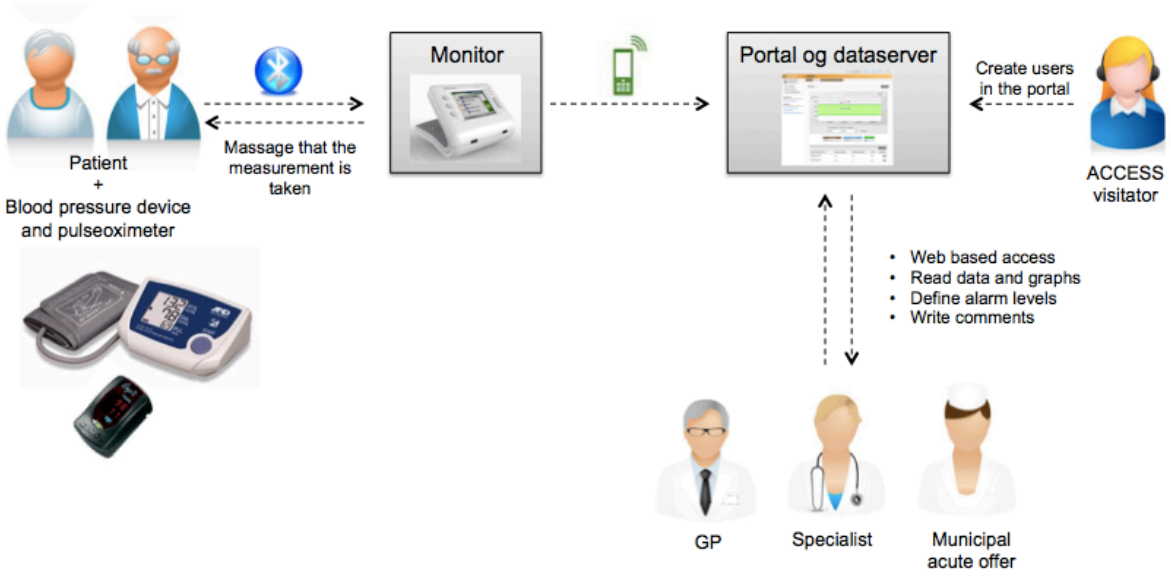

Figure 5: Setup for telemonitoring

4.2.2 VIDEO CONFERENCING

The video conferencing was available for communication between the nurses in the municipal acute offers and the medical specialist at the hospital. For the video communication, the solution Cisco Japper developed by Cisco was used. The municipal nurses could access the video solution through their iPads and the solution was installed on stationary PC's at the hospital.

4.2.3 HOTLINE

The nurses in the municipal acute offers were offered a 24/7 hotline to the medical specialists at the hospital. The hotline could be used outside the GP's opening hours and could be used as a direct admission option bypassing the doctor on call if the patient's condition deteriorated.

5 RESEARCH METHOD

This chapter includes four subsections; first the research approach will be described including the relevant aspects related to collecting and performing interpretive research. Next subsection will touch on how the data collection has been carried out in the present study. In the third subsection the basis for the data analysis will be covered. Finally, in the fourth and fifth subsection reflections on the research process will be elaborated and the limitation of the study will be discussed.

5.1 RESEARCH APPROACH

At the beginning of the ACCESS-project the use of the telemedicine solutions was supposed to be evaluated in a RCT design, where it was tested whether the telemedicine intervention had an effect on the projects primarily and secondary outcomes(72). Early in the project period it was recognized that the use of the telemedicine solutions was limited and the technology was not on a stage where it could be considered stable and mature. Combined with other adjustments in the project this resulted in editing the research protocol, where the telemedicine intervention now was to be evaluated through qualitative and interpretive methods instead of in a RCT design (74). The Danish Health and Medicines Authority and The National Committee on Health Research Ethics approved the adjusted research protocol.

5.1.1 QUALITATIVE AND INTERPRETIVE RESEARCH

Through this research study it is attempted to achieve an understanding of the social and technical reality underpinning the telemedicine intervention in the ACCESS-project, by applying a qualitative and interpretive research approach. The interpretation and data analysis take place in the theoretical framework presented in chapter 3.

The qualitative paradigm aims to gather an in-depth understanding of human behavior and the reasons that govern such behavior. Qualitative methods can be applied by preforming interpretive research, *"Aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by its context*"(46). In recent years interpretive research has emerged as an important approach in information system research and is recognized to

help IS researchers to understand the complex process of implementing ICT in organizations. Understanding is gained by interpreting the interpretation of the subjects researched and the actions occurring in a social or organizational context, such as in a healthcare environment (75,76). The fundamental aspect of interpretive research is elaborated by Klein and Myers (75) who outline that within IS research an interpretive approach entails the assumption that our knowledge is gained through construction of several elements like language, shared meaning, tools, artifacts and documents. This implies that many elements contribute to the way our knowledge is constructed. Interpretive research focuses on the dependencies and interdependencies of construction of these elements, and the complexity where they emerge in the making of situations, to understand the phenomena through the meaning that is assigned to them(75).

When carrying out interpretive research it does imply writing neither a predefined research hypothesis nor a rigid research protocol, rather one has to be open-minded and discover what is 'out there'. This involves trying to grasp what is characteristic to the setting researched and trying to understand why and how things happen(77). When one wants to generate a deeper understanding of the processes of ICT development and implementation, such as in the ACCESS-project, a qualitative and interpretive research approach is preferable. To produce understanding of complex change processes that comes along with implementing ICT and how behavior and organizations are influenced hereby Popay(47) argues, "*Evidence derived from qualitative research has an important contribution to evaluation of the more complex picture*".

However, performing interpretive field research is no easy task when it comes to assessing other people's interpretations (78) . Interpretive data can be collected in various ways in terms of documents, archival records, interviews, direct observation, participant observation and physical artifacts (78) **.** In this research study data are collected mainly through interviews and through reviewing relevant project documents. Walsham (78) elaborates on interviewing as a source for collecting data for interpretive research, "*Interviews are the primary data source, since it is through this method that the researcher can best access the interpretations that participants have*

regarding the actions and events which have or are taking place". Furthermore do the interviewing technic allow the researcher to step back and reflect upon the interpretations of the details in the interview. Myers and Newman (79) have examined the craft of performing qualitative interviews in IS research and highlight several important factors to consider when performing an interview. One factor is the importance of 'situating the researcher' before the interview takes place. They see the interview as a social encounter where the data gathered from interviews are idiographic. Furthermore, they emphasize the importance to interview a variety of people within an organization to represent various voices and thereby avoid elite bias (79). Another important factor recognized by Myers and Newman (79) is that everyone is an interpreter, "*The researcher to the interpretive world of the subjects, researchers them selves, and the audience they write for".*

In an interpretive field study interviews should be supplemented with other forms of field data(76). Walsham (76) describes, that these field data may include "*press, media and other publications on the sectoral context of the organizations being studied. Internal documents, if made available, may include strategies, plans and evaluations".* This is supported by Silverman (80) who see written material as a resource for social scientist to get a better insight into how a social institution operates. An advantage of reviewing written material is that the researcher does not have to be in direct contact with the persons producing the material and hence limiting that the researcher is influencing the data(39). On the other side the disadvantages of using written material are that the documents available may be limited or partial and the researcher need to have in mind that the documents have been written for some other purpose than for the research, which makes it difficult or impossible to allow for the biases or distortions that this introduce(39).

Finally, when conducting interpretive research it is particular important to consider how the research is reported. Walsham (78) elaborates, "*The issue of how to report field work is important in all research, but it can be argued that it is particularly critical in interpretive case studies. Interpretive researchers are not saying to the readers that they are reporting facts; instead, they are reporting their interpretations of other peoples interpretations*"(46).

5.1.2 KLEIN AND MYERS' SEVEN PRINCIPLES FOR CONDUCTING INTERPRETIVE RESEARCH

When doing interpretive research it can be a challenge to secure the quality of the study in order to publish the outcome of the interpreted data. Klein and Myers(75) argue, "*As the interest in interpretive research has increased, however, researchers, reviewers, and editors have raised questions about how interpretive field research should be conducted and how its quality should be assessed*". To ensure the quality of interpretive field research, Klein and Myers(75) have described a set of seven principles for conducting and evaluating interpretive field research in information systems, which will be elaborated in this section

The fundamental principle of the hermeneutic circle: This is seen as a meta-principle upon the following six principles. The principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form(75). To do interpretive research the researcher needs to have basis knowledge about the field researched. However, the researcher also needs to be open for, that new interpretations may change and affect the basis knowledge. Which again can be used for new interpretations. The fact that new knowledge will influence the interpretation can be seen as a challenge or a consequence of doing interpretive research. The iterative nature of interpretive research could also induce that the research questions will change during the research phase.

The principle of contextualization: In interpretive research performed on information systems one of the key tasks is to seek meaning in the context. It is therefore important to clarify both the historical and the social context so that the intended audience can see how the current situation under investigation emerged. When doing interpretive research the researcher needs to see the people as the producers and not just as products of the history, which leads us back to the hermeneutic circle(75).

The principle of interaction between researchers and the subjects: Data are socially constructed through the interaction between the researcher and the informants(75). This means that the researcher always in some way will have an effect on the data collected, and it is impossible to stay neutral.

The principle of abstraction and generalization: This principle stresses that it is important to relate interpretive research to interpretative theoretical abstractions and general concepts(75). According to Klein and Myers(75) "*Interpretive researchers in information systems tend to generalize to philosophically abstract categories but to social theories such as structuration theory and actor network theory*".

The principle of dialogical reasoning: This principle points to that the researcher must confront his preconceptions that guided the original research design with the emerging data. It is important that the researcher makes the basis of the research as transparent as possible(75). This leads back to the principle of the hermeneutic circle, since prejudices is a necessary starting point of understanding. A possible challenge in the iterative research process is that the interpretations of the researcher may have influence on the research design.

The principle of multiple interpretations: The sixth principle is the principle of multiple interpretations. It is important as a researcher to seek out and document the different viewpoints in a study; hence the participants in a study might have different interpretations on the same events under study. The researcher should confront the contradictions in multiple viewpoints and revise her/his understanding accordingly (75). A possible challenge related to this principle may occur doing the research if the informants are having multiple interpretations when using the technology. In an interview situation the researcher needs to be ready to get the informants to elaborate on the underlying reasons for these multiple interpretations, in order to gain a deeper understanding of the underlying context.

The principle of suspicion: The last principle stresses, that the researcher should possess a certain amount of suspicion(75). Meaning that she/he should not take every thing for granted and be sensitive to possible bias and systematic disorders in the narratives collected from the participants.

The principles for conducting interpretive research will provide the basis for reflections concerning the method used in this research study. The reflections will be elaborated later in this method chapter.

5.1.3 A HERMENEUTIC PERSPECTIVE

As stated by Klein and Myers (75) interpretive studies are closely linked to the hermeneutics. Having the principles of the hermeneutic circle in mind, it is clear that it is reflected in the foundation of this research study. When I first was in contact with the ACCESS-project is was apparent that the telemedicine solution was not used as expected. It was therefore desirable to clarify how and why the different parts of the telemedicine solution were used in order to compare it with the expectations. Based on my reviewed knowledge and interpretation of how the telemedicine solution was used, it became clear that there was a gap between initial expectations and the actual outcome. For one to understand this gap it turn out to be important to analyze and understand the different parts constructing the development and implementation process for the purpose of understanding the whole. My renewed preconceptions obtained through the qualitative data are reflected through out the entire thesis.

5.2 DATA COLLECTION

The research material in this thesis is based mainly on interviews and though reviewing relevant project documents. The data collection was carried out in the geographical setting of the ACCESS-project and took place from July 2014 until November 2014.

5.2.1 INTERVIEWS

The main resource for data collection was interviews. Eight interviews were conducted in the period from July 2014 until November 2014 (Table 2). The interviews lasted between 25 and 55 minutes and included one-two participants. The interviews included 11 informants in total representing, six nurses in the municipality (NU 1-3), two municipality project managers (MPM 1-2), two general project managers (PM 1-2) and a representative from the vendor of the telemonitoring solution (VEN1). One of the nurses and one of the general project managers did also participate in the telemedicine workgroup and likewise was one of the general project managers also a medical doctor and head of the research department.

Semi-structured Interviews		
Interview date	**Location**	**Interviewee**
07.16.2014	Research department	PM1 (n=1)
09.17.2014	Municipality of Tønder	MLM1 (n=1)
10.03.2014	Municipality of Sønderborg	MPM2 (n=1)
10.21.2014	Vendors offices	VEN1 (n=1)
10.24.2014	Municipality Tønder	NU1 (n=2)
10.23.2014	Municipality Sønderborg	NU2 (n=2)
11.11.2014	Municipality Haderslev	NU3 (n=2)
10.31.2014	Research department	PM2 (n=1)

Table 2: Interviewed subjects

The interviews were performed as semi-structured interviews (81). This structure was chosen to make sure that topics previously identified as interesting were covered, while still leaving me as the interviewer the freedom to chose my wording and ask additional follow-up questions. The interview guide was adjusted between the different interviews, which reflects that my preconception with which I interpreted the interviews changed during conducting the interview data. Semi-structured interviews are recognized as appropriated when the researcher is closely involved with the research process(39), which is the case in this research study.

All interviews were with permission from the interviewees recorded digitally on a smartphone and subsequent verbatim transcribed in to 117 pages. The interviews were carried out and transcribed in Danish. The citations used for the case narratives in this thesis are all translated to English by best endeavors with respect for the Danish original citation.

The subjects selected for interviews reflect the knowledge gained through my given insight into the project, obtained through my role as a project manager and the research questions to be answered. Based on the underlying recognition of that there was a gap between the expectations of how the technology was supposed to be used and how it

was actually used, it was assumed that the selected interviewees could contribute with interesting and relevant knowledge associated to the use of technology and the processes occurring during the development and implementation phase.

5.2.2 DOCUMENTS

To obtain a thorough insight and background knowledge about the process lying behind the use of the telemedicine solution, several project documents were reviewed. The project documents helped to access knowledge regarding decisions taken previously in the project before the evaluation of the telemedicine solutions was started. The project documents listed in Table 3 represent documents found relevant for the evaluation of the telemedicine solution. The project documents reviewed include the research protocol, the supplementary application, meeting minutes from the telemedicine workgroup, a meeting minute from a project group meeting and the requirement of specification.

Project documents	
Date	Document
Aug. 2013	Research protocol for the ACCESS-project
May. 2014	Supplementary application for the ACCESS-project
Mar 2013	Meeting minute from meeting in the telemedicine work group
Apr. 2013	Meeting minute from meeting in the telemedicine work group
May. 2013	Meeting minute from meeting in the telemedicine work group
Aug 2013	Meeting minute from meeting in the project group
May. 2013	Requirement of specifications for the telemedicine solution

Table 3 List of relevant project documents

5.2.3 QUESTIONNAIRES AND QUANTITATIVE DATA

The empirical findings further draw upon descriptive quantitative data in terms of how much each telemedicine element has been used. The data are based partly on data drawn from the shared portal showing if the vital values were transferred automatically or typed in manually, and partly on questionnaires filled out by the municipal nurses after the acute treatment offer had ended. The nurses answered following questions regarding the use of the telemedicine solutions:

How many times was the hotline to the medical specialist used?

- 0 times
- 1 time
- 2 times
- 3 times
- 4 times
- 5 times
- More than five times

How many times was the video communication used?

- 0 times
- 1 time
- 2 times
- 3 times
- 4 times
- 5 times
- More than five times

How much is the shared portal used to access vital values?

- It was not used
- It was used one time
- It was used a few times
- It was used a lot

Is the medical specialist asked to look at the vital values?

- Yes
- No
- The patient was admitted day 0

5.3 DATA ANALYSIS

When carrying out a qualitative interpretive study in a complex setting one tends to create an abundance of information. The researcher therefore needs to create a strategy for how to structure the data, what to include and what to omit while at the same time create an overview of the data.

For the purpose of data analysis the transcribed data were analyzed based on meaning categorization where the interviewed data were divided into categorizes representing the use of technology and the different stages in the design and implementation process (81). During the analysis the categorization was created and adjusted following an iterative process inspired by a hermeneutic interpretation of the transcribed data. To obtain the best overview the software program Nvivo was used. The program allowed comparing the different informants' views in relation to the different categories. The excerpts from the project documents, which I found relevant and interesting, were likewise categorized using Nvivo.

When performing an interpretive research study, theory can be used "*as an initial guide to design and data collection, as part of an iterative process of data collection and analysis, or as a final product of the research"*(76). Furthermore, using interpretative theoretical abstractions can help to make the collected data more generalizable(75). Throughout my fieldwork I have been inspired by the principle of the hermeneutic circle, which is reflected in the way the collected data has been processed and interpreted(75). When I first started the fieldwork I was familiar with the theoretical viewpoint of looking at ICT in healthcare with a socio-technical perspective, which has been reflected in the questions asked during the interviews and the interpretation of the interviews and documents.

However, during the process of writing this master thesis I have achieved a greater theoretical and practical understanding, through reading scientific papers, discussion of the method approach with fellow researchers and through discussion with and guidance from my supervisor. Concurrently, when I was carrying out my fieldwork I became familiar with the theoretical perspective presented by McLeod and Doolin (62) where they look at IS development as situated socio-technical changes by applying a

process approach. I found that this theoretical perspective was ideal to analyze the data collected in order to clarify why there was a gap between the initial expectations and actual outcome. Choosing a theoretical framework for the interpretation of qualitative data is supported by Walsham(76) who argues, "*My first piece of advice for new researchers is for them to choose theories which they feel are insightful to them*".

5.4 Reflection on method

The fieldwork was carried out while patients still were enrolled in the research study, it can therefore be argued that the data collection took place too early. However, the project had been running 9 month prior to starting the fieldwork and through my work as a project manager, it became clear that the (absent) use of technology had reached a state where it would not be subject to major changes during the rest of the project period. It was therefore assessed that the time period for conducting the fieldwork was appropriated in relation to the research questions to be answered.

One of the key concerns when performing interpretive research is gaining and maintaining access to the research field(76). In this research study, gaining access to the research field was not a big concern. It was a desire from the people behind the ACCESS-project that the telemedicine solution was to be evaluated and I as a researcher was given the freedom to perform the evaluation. The involved parties all agreed on the evaluation and encouraged potential informants voluntary to participate in the interviews. Likewise, there were no problems involved in getting access to an interview with the supplier. All interview appointments were made to satisfy the time schedule of the interviewees. During the interviews I experienced that the interdisciplinary knowledge that I have gained through my education and work as a healthcare technology engineer was useful to understand the different perspective of the informants on how they experienced, on one hand the use of technology and on the other hand the development and implementation process. Nevertheless, my knowledge about the municipal nurses' work routines was limited and when interviewing the nurses I had to ask additional questions to understand the use of technology in relation to their daily work routines. I experienced during the process of collecting the interviews that my interpretation of the use of technology and the design and implementation process changed. This experience can be related to Klein and Myers

(75) fundamental principle of the hermeneutic circle stressing that knowledge is gained by "*Iterating between considering the interdependent meaning of parts and the whole that they form*". By interviewing informants with different background I evaluate that I have achieved a more complete understanding and knowledge partly about the use of technology and partly on the development and implementation process. This also correlates with the principle of multiple interpretations(75), where the researcher looks at and tries to document the different viewpoints occurring when researching a specific research setting.

In retrospective, I realize that when I started the data collection I had some preconceptions. For instance, through informal talks with the project managers my attention was drawn to the many technical issues related to the use for the telemedicine solutions. However, when I look back I realize that it is difficult to know everything about a setting, before digging into details. Throughout the entire study I had to face my preconceptions and take into account the new knowledge of the 'reality' gained though interpreting the collected data. This new picture of the 'reality' was far more complex than I first had thought, thus the importance of paying attention to the argument presented by Walsham (78), that there is a need to "*preserve a considerable degree of openness to the field data, and a willingness to modify initials assumptions and theories*".

During the process of writing this master thesis, I had the opportunity to present the results oral in different occasions. The results were presented at a seminar focusing on how technology can enhance treating patients at home. At the seminar there were representatives from different telemedicine vendors, different hospitals and municipalities from all over Denmark. Moreover, the results were presented together with the other results from the ACCESS-project at a happening where all the project's stakeholders were invited. In connection with presenting the results, it led to subsequent plenary discussions. Viewed in a hermeneutic perspective, these public discussions of the results may have affected my interpretation of the results. It is worth mentioning that the discussion chapter was written following these public discussions, and therefore has been affected by and structured according to what were emphasized in these public discussions. Seen in the light of the seven principles presented my Klein and Myers (75), this iterative and hermeneutic approach to handling and analyzing the

data may contribute to see and discuss the separated parts of the collected data in order to understand the whole. Furthermore the iterative approach may help to make the data more concerning to the organizational contextualization which they are collected within.

5.4.1 My role as a researcher

"*Interpretive researchers are attempting the difficult task of accessing other people's interpretations, filtering them through their own conceptual apparatus, and feeding a version of events back to others, including in some cases both their interviewees and other audiences. In carrying out this work, it is important that the interpretive researchers have a view of their own role in this complex process*"(78).

This quotation by Walsham underscores the importance when doing qualitative interpretive research for the researcher to reflect on one's own role in the research setting. When becoming a researcher one's role can be identified as an involved researcher or as an outside observer. According to Walsham(78) neither of these roles should be viewed as an objective researcher, since the collection and analysis of data always involve the researchers own objectivity and interpretation. This is supported by Klein and Myers(75) principle of interaction between the researcher and the subject researched, where the researcher always in some way will have an effect on the data collected, and it is impossible to stay neutral.

As an active participant in the ACCESS-project having possessed the roles as both a project manager and a qualitative researcher it is clear that my role as a researcher will be categorized as being an insider. Being an inside researcher may be associated with both negative and positive sides. On the one hand, my presences as an active participant in the project means that I cannot avoid affecting or being affected by the context in which I have collect data. I have throughout my research and specific when conducting the interviews attempted to be aware of that my two-sided role might have influenced the way I have performed the interviews and interpreted the collected data. Before starting the interviews I have deliberately made it clear to the interviewees that I was there in the capacity of having to collect data for the evaluation of the telemedicine solution, and not in the role of being a project manager. Furthermore, a challenges

related to the role of an involved researcher is that it is extremely difficult to document how I have influence the research context(78). On the other hand being an inside researcher has given me a valuable insight into the contextual background of the research setting and I have been present in many occasions which have given me a direct sense of the setting researched from the inside, which would not have been possible for an outside researcher. By comparing the advantages and disadvantages by being an inside researcher I assess that by being aware of the challenges connected to my role, my role as both a project manager and a researcher has given me a predominantly advantage in performing the evaluation of the telemedicine intervention.

I view my role as an active project member as an opportunity to get a deeper insight into the research setting and to achieve a more detailed understanding of how the technology is used and how the design and implementation process has progressed. I assess that this increased knowledge has helped me to perform more targeted interviews as a basis for a more appropriate data analysis. Finally, I have not included action research or observational studies as a part of my study methods, even though I might have been doing it indirectly.

5.4.2 Ethical considerations

This evaluation is carried out as a part of the ACCESS-project, which is founded by The Danish Health and Medicines Authority. Before initiating the evaluation method, the intended interviews were reported to both The Danish Health and Medicines Authority and the National committee of Health Research Ethics, which accepted the evaluation approach. In the adjusted research protocol it was clarified that all interviews data would be handled with respect for the anonymity of the interviewees(74). All data were saved with unique ID numbers, which could not be traced back to the informants. Furthermore, all informants were informed that they had the opportunity to renounce to participate in the interview.

However, considering the interviews performed, the degree of anonymity can be discussed. As an example it is difficult to enforce the anonymity of the main project managers, since they both have a very unique dominating role in the project. One of them was both a project manager, head of the research department and a medical

doctor, and is contributing with quotations from all perspectives in the empirical findings. I have chosen not to use their names, and where it is possible I will use the expression 'main project manager' regardless of how cited.

5.5 LIMITATION OF THE STUDY

The ACCESS-project is an extensive project with several stakeholders involved across multiple organizational levels. This evaluation of the telemedicine intervention has emerged as an iterative process where I as a researcher gradually have adjusted the study, in regard to what I interpreted as relevant to the evaluation.

It can therefore be discussed if the informants chosen for interviews are sufficient. In the result chapter, the two first process narratives describing the establishment of the research protocol is based partly on an interview with one of the main project managers and partly on the research protocol. It can be argued that it would have been appropriated to interview participants from the steering committee who had encourage the establishment of the ACCESS-project. However, the informants selected for interviews reflect the iterative nature of the research process wherein my interpretation of what was important with respect to the evaluation changed during of the process. The design and implementation phase was evaluated from a practical perspective, but subsequently it is recognized that it could also have been interesting to incorporate perspectives from a more organizational level, by interviewing participants from the steering committee, but due to the limited timeframe of this study these potential informants were not included.

6 EMPIRICAL FINDINGS

In this chapter the empirical findings from the case study will be described by applying a narrative approach, as described in the theory chapter. The narratives will help to facilitate an understanding of how the technology has been used and the process by which specific effects and outcomes have emerged over time(62). The chapter reflects the iterative process by which the data collection has emerged. First, the actual use of technology will be described. Next, as a response to the experienced gap between initial expectations to the technology and the actual use of technology, the narratives will be divided into 7 episodes representing the development and implementation process. In the description of the case narratives the main focus will be on situated actions seen as socio-technical changes and the consequential influences and effects that shaped the telemedicine development and implementation process in the ACCESS-project. It is important to emphasize that the process described through the case narratives is dynamic and multi-dimensional and the outcomes emerged from a complex and interdepending relationship between people and technology within an organizational context. The representation of dividing the process narratives into episodes is inspired by McLeod and Doolin(62) and is a way to decomposition the collected data and must be seen as a simplistic way of communicating the complexity affecting the development and implementation of ICT in healthcare. The episodes cannot be perceived as chronological, as individual episodes takes place simultaneously, which means they will have reciprocal influence on effect and outcome.

6.1 USE OF TECHNOLOGY

During the project period 131 patients have been included in the ACCESS-project out of which 69 received the treatment offer including telemedicine. The use of the telemedicine solution evolved in different ways with respect to the various telemedicine elements. Therefore, this section is divided into three subsections referring to telemonitoring and shared platform, video communication and the hotline corresponding the elements included in the project.

6.1.1 USE OF TELEMONITORING AND THE SHARED PLATFORM

The telemonitoring part entailed that the nurses measured blood pressure, pulse and saturation on the patients. When visiting a new patient the municipal nurses explained that they always used the devices to measure blood pressure, pulse and saturation as a part of evaluating the patient's condition. One of the municipal nurses further explained, *"I use the values to ensure if the disease is properly treated or not. So in that way it gives the feeling of security, I think".*

The nurses in the acute teams were used to use the devices for measuring blood pressure, pulse and saturation and one of the nurses tells, *"There is nothing new in this equipment. We used it even before the project started on all our patients".* On the other hand, the nurses in the acute units at the care centers tell that the saturation device was new to them. However, they found the new device easy to use and very relevant for evaluating the patients' condition. The nurses both situated in the acute teams and at the acute units experienced challenges with the saturation devices, which they elaborate on, "*We experienced that if the battery in the saturation devices had been sitting in from time to time, it was simply empty when we had to use it again".*

The devices for measuring vital values were intended automatically to transfer the measurements to a shared online portal. The nurses in both the acute teams and acute units experienced challenges associated with the wireless transfer of the measurements. They described how they have struggled to get the wireless transmission to work. One of the nurses tells, "*It is so unprofessional when you stand and struggle with it".* This quote is supported from another nurse, *"And so you use a lot of time getting this equipment to work, and you actually have not really time for the patient lying in bed, and that is not good*". The nurses described how they have been very persistent and how they have tried to use the solution properly every time they had a new patient. However, some of them describe that they have only experienced that the solution worked as expected one or two times. This is supported by one of the local project managers who describes, *"I remember that I got an email where it was described that it worked. Well the success stories were so rare that they wrote to me when it worked.*"

The nurses' perception of the few successful wireless transmissions is supported by the illustration in Figure 6, which shows that the measured values only have been fully automatically transferred in 5 percent of the patient pathways.

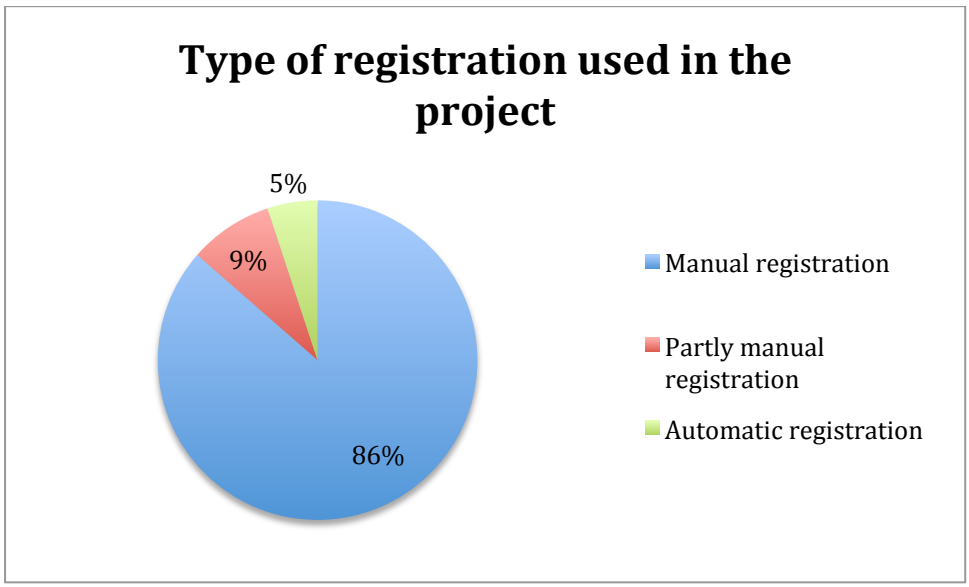

Figure 6: Type of registration used in the project, based on data extraction from the shared portal

The nurses tell that when they experienced too many challenges with the technology they gave up, and instead focused their time on the patient and chose to register the measurements manually in the shared portal.

The nurses also described how they had to perform double registration, when they had to register the measurements both in the shared portal and in their own record system. They pointed out that it could be very useful if the telemedicine system could had send the vital values directly to their existing care journal, and thereby saved the manual double registration. One of the nurses expresses, *"Well telemedicine could have been incredibly smart, supposed it could have worked consistently with our record system".*

All the interviewees stressed that the two biggest factors affecting the challenges related to handling the transfer of the measurements were; one that the cellular network coverage used in the project was very unstable. Second, there have been very few patients included in the project, which affected that the nurses have not obtained any routine in using the technology. One of the local project managers expresses, *" It is*

difficult to achieve a routine when we have had so few patients. If we have had ten patients a day, the routine would have had been completely different".

The measured vital values were all registered in the shared portal, with the intended use that both the healthcare professionals in the municipality and the specialists at hospitals could access them. However, the nurses tell, "*We have not had a feeling that there is anyone who has looked at the values"*. This is supported by the reported number of times the nurses have asked the medical specialist to look at the vital values in the portal, which equals zero. Instead, when the nurses communicated with the doctors they used the already established communication channels and looked at the vital values registered in their own care system when reporting on the patient's condition. Figure 7 illustrates how many times the portal has been used in the respective patient pathways where the patients received telemedicine, the results are reported by the nurses in the municipality.

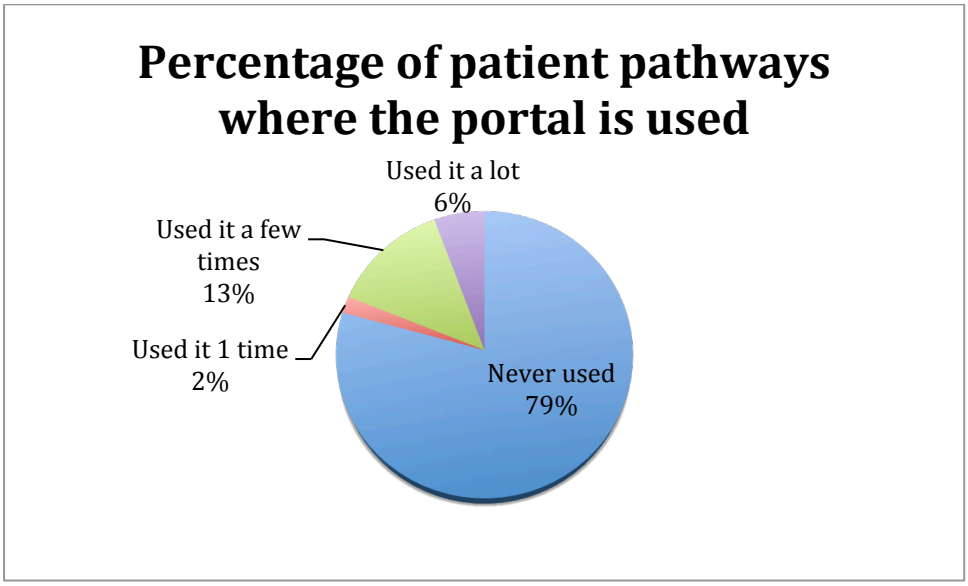

Figure 7: Use of portal reported by the nurses

The nurses also pointed out, that it had been confusing that the telemedicine offer was differentiated between the different treatment options tested in the project. The healthcare professionals at the hospital had access to the shared portal whereas when the general practitioners had the treatment responsibility, they where not having access to the platform. This is elaborated by one of the nurses, *"And so one can say that there is*

no one who has been ready for this. The hospitals are indeed not geared for it, and they have not use it in any way. And the general practitioners have no access to the system either, thus it's the usual process. So there is not anyone that have been ready to use it".

The nurses tell, when the technology does not support the daily work it was easier just to report the vital values as they are used to, when talking with the doctors. As long as the telemedicine is not used as an active communication tool, they do not need it. A nurse expresses, "*But we do not need it necessarily. Unless that it is the basis we cooperate from".* Another nurse support this quote by saying, "*The problem may has been sufficiently small so we could just make an agreement on the phone. There are also cases where the specialist did not knew enough about the project to be able to test it. And I think in general, the need is not so big".*

However, despite lack of success related to the use of the telemonitoring solution the nurses interviewed, all had an optimistic perspective on using telemedicine solutions in their future work. One express, "*I think even if we do not have the very best experiences, I still think we are open to get it to operate*".

Finally, the shared platform used in the project had two different aims, on one hand to share the vital values among the healthcare professionals and on the other to serve as an organizational tool. One of the project managers described that the portal worked really well for the organizational purpose to create an overview of the patient pathways. The project manager tells, *"But the platform just worked. I think it has been a really good way to bring it all together, we have been able to communicate and able to follow patients through the project".*

To sum up, the use of the telemonitoring has been challenged by technology problems and few inclusions resulting in limited routine use. Furthermore, it was highlighted that the technology did not support the present workflows and did not correlate with the need of the users. However, the shared portal has been successfully used as an organizational tool.

6.1.2 USE OF VIDEO COMMUNICATION

When the interviewees were asked about the video communication, it was clear that the solution had not been used in the project. This is supported by the nurses reported use of video communication, which showed that the solution has never been used in the project. There was only one nurse who had tried the video communication as a part of a test and the rest of the nurses told that they have never tried to establish a video call. One of the nurses explains, "*Actually, I have always believed that it was not an opportunity to use it*". Another follows by saying, "*But I think the video conference is forgotten".* And a third nurse expresses, *"I actually thought that the video communication was skipped because the quality was too poor".*

The nurses pointed out that the need for establishing a video connection was not there, especially since it was only possible to connect with the specialists at the hospitals. This means if the general practitioner had the treatment responsibility, the nurses could still only establish a video communication with the hospital. One of the nurses said, "*We are familiar with explaining the patient's condition to a new doctor who has not seen the patient in the last 3 hours. It would make no sense to use the video conference to show the patient to a specialist at the hospital, where it is the general practitioner who has had the treatment responsibility. The hospital will have nothing to compare with and in those cases, we might as well just explain our observations as we are used to*".

6.1.3 USE OF HOTLINE

The hotline was established to support the nurses in the municipality and the general practitioners in situations where they needed advices from a medical specialist related to the treatment of the patient. The nurses had different feedback regarding the use of the hotline. Some of them had never used the hotline while others had used it a few times. This is supported by Figure 8, which illustrates the percentage of patient pathways where the hotline is used, according to the nurses reporting.

One of the nurses explains her experience of the hotline, "*I have tried it a few times. Sometimes it has worked, where I have been given all right qualified help. Other times, it is clear that they [medical specialists] have not had the time or have not known to the project*".

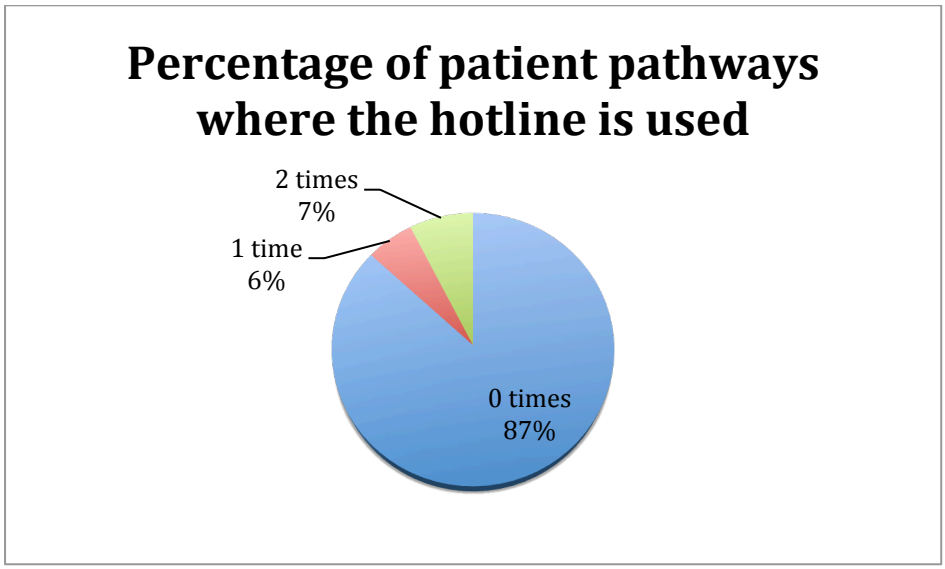

Figure 8: Percentage of patient pathways where the hotline is used, reported by the nurses

When the nurses used the hotline they often experienced that the doctors on call did not knew about the project. However, they have managed to find a solution to the current problem in the given situation.

The nurses reflected that the limited use of the hotline may be a result of that they have not had the need to use it. Two of the nurses tell, *"We have had an overview, the treatment plan is good and there has been no specific complications. We felt comfortable in the process we have had and therefore may not have needed the hotline".* The use of the hotline may likewise have been influenced from the fact that there have been very few inclusions in the project. One of the nurses further elaborates, "*I must flatly admit that I have actually forgotten I have the opportunity*".

6.2 PROCESS NARRATIVES

The process narratives presented in this section can be read alongside with Figure 11 presented in the discussion chapter (Chapter 7). The process narratives are divided into seven episodes that each contains a situated action influenced by the effects of socio-technical changes occurring during the development and implementation process.

6.2.1 EPISODE 1.A: FOUNDATION OF THE PROJECT

In fall 2012 the Danish Health and Medicine Authority encouraged cross-sectorial projects to apply for a pool of funds granted to strengthen cooperation between regions, municipalities and general practitioners, regarding subacute/acute offers and with the aim to reduce inexpedient admissions and readmissions to the hospital(73). The local coordination forum for the hospital of Southern Jutland's admission area (SOF I SYD) encouraged the recently established research department at the hospital to prepare and submit a project proposal. The timeframe was limited and the project proposal had to be ready and submitted within one and a half month. The head of the research department explained, *"It was a requirement from the hospital that we should bid on this project. It was kind of a prestige project, as there was not many projects like this at the hospital."*

It was decided to establish a cross-sectorial project as cooperation between the hospital of Southern Jutland and the four municipalities, Haderslev, Sønderborg, Tønder and Aabenraa and the general practitioners in the hospital's admission area. The project was named the ACCESS-project.

A temporary workgroup was established, consisting of the head of the research department from the hospital, two general practitioners, two nurses from the municipality and two managers from the municipalities. There were held two-three meetings where the scope of the project was identified. The workgroup agreed upon to establish a research study investigating how to prevent short acute admissions to the hospitals among acute elderly medical ill patients. The study was designed as a RCT where the main intervention in the study was if the patient was seen by a medical specialist or by the general practitioner. At the same time the workgroup found it interesting to investigate one of two alternatives: If the patient was treated at home or

at an acute unit in a care center. The municipalities had already arranged that in the municipalities of Sønderborg and Haderslev the patient was to be treated at home. While in Aabanraa and Tønder acute units at the care centers were established. The two different acute offers in the municipalities, were evaluated as a comparison study. The study design reflecting the basis for the establishment of the project is illustrated in Figure 9. According to the head of the research department, both general practitioners and the nurses in the municipalities supported the appropriateness of investigating if the short admissions to the hospital could be avoided. Furthermore, various patient organizations were consulted and confirmed that often it would be in the patients' interest to avoid a short admission and instead remain at home.

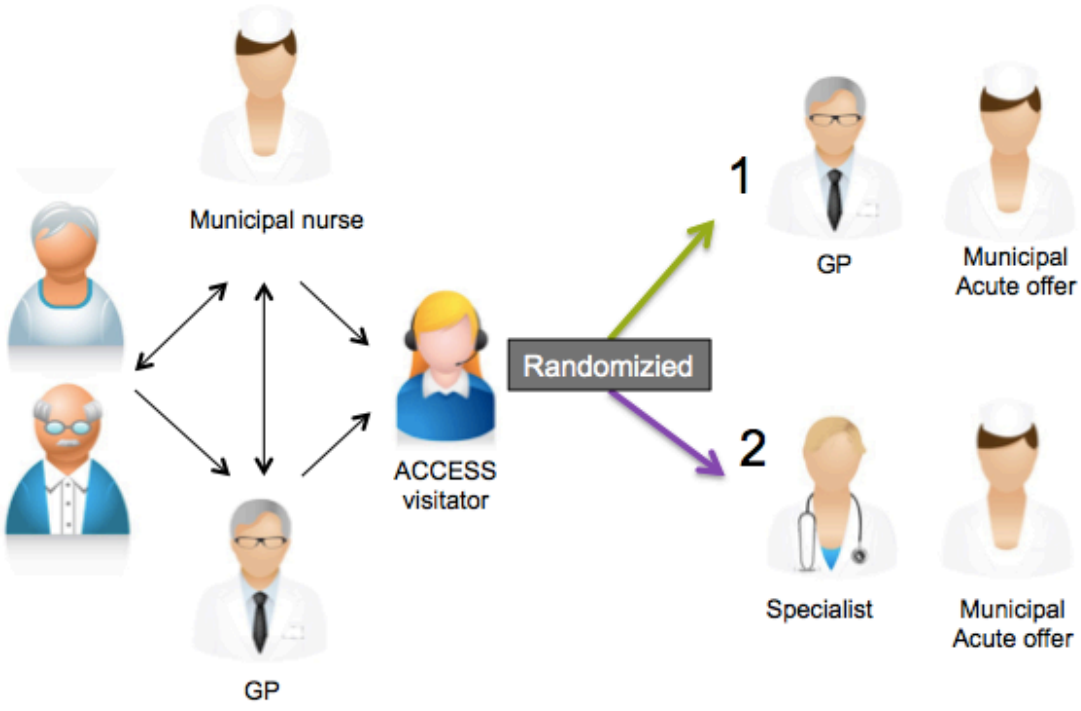

Figure 9: Project design without telemedicine addition

6.2.2 EPISODE 1.B: INCLUDING TELEMEDICINE AND DEFINING NEEDS

Both the hospital management and the temporary workgroup were of that opinion that they had to include some kind of ICT in the project proposal to be considered for the pool of funds in relation to the project proposals from the other Regions in Denmark. However, it was not a written requirement in the bulletin announced by Danish Health

and Medicine Authority. The inclusion of a telemedicine solution was seen as a necessity and the workgroup discussed different options during the 2-3 meetings. The various actors in the workgroup contributed their viewpoints on how to include ICT in the project. The nurses in the municipality pointed out that it was important to be able to follow the patients' condition. The head of the research department expresses, *"The nurses were particularly aware of that when the patient was at home, they would like to be able to follow the patient from somewhere else".*

Additional the nurses would like to have an alarm system to alert them if the vital values exceeded a certain limit. It was further discussed that the measured vital values should be available for all involved parties, including the acute offers in the municipality, specialists at the hospital and general practitioners. The head of the research department who also is a specialist at the hospital describes, *"From the hospitals viewpoint, we agreed that it could be nice if we could exam the vital values when patients were treated in the municipalities. So we did quickly agree on that telemonitoring should be part of the solution. "*

The nurses and the general practitioners did also point out that it was important to have direct access to get in contact with a medical specialist. They desired a hotline to call if the patient's condition worsens. Therefore, a low-tech telephone hotline was established as a part of the project. Finally, the board of the hospital argued it could be interesting to incorporate and test a solution for video communication. One of the project managers explains, "*Again, it was the management that indicated that the video communication is incredibly popular. So we had to think it into the solution in some way so that we could try it out*."

The project manager continues by saying given his role as a medical specialist, *"We also had interest in whether it was possible to see the nurses and patients if it was possible. Photos or video of the patient would be a way for us to create an overview of how sick the patient is."*

Due to the limited time for creating the research proposal the workgroup did not do much to collect evidence and experiences from other projects. According to the project

manager, they had briefly been in contact with another Danish telemedicine project. Additionally while creating the project proposal, they did not do any literature search neither did they look into other projects, in relation to gather knowledge about telemedicine. Furthermore, had no one of the participants in the workgroup previous experience with developing or implementing telemedicine.

In the final project proposal the study was designed as an RCT study with respect to two interventions, seeing a medical specialist or not, or a combination of seeing a medical specialist or not combined with receiving telemedicine or not. The study design is illustrated in Figure 10.

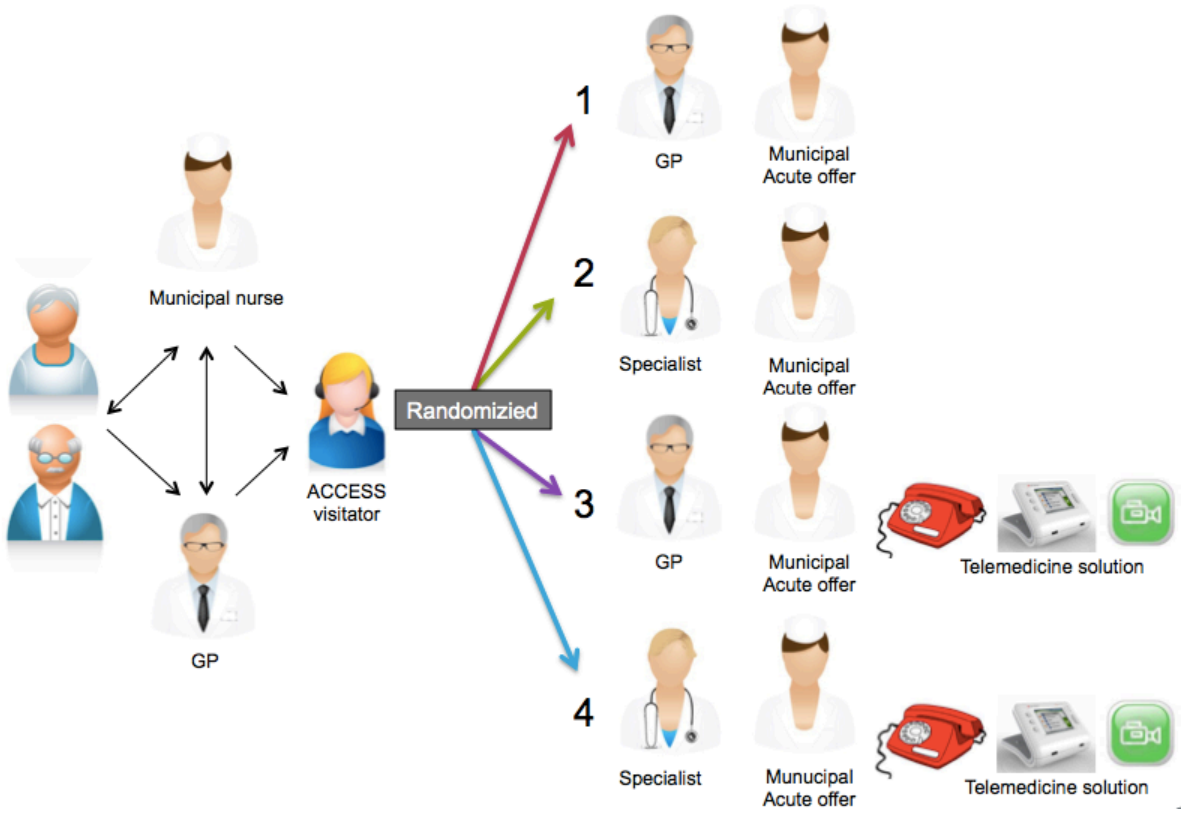

Figure 10: Study design included in the final project proposal

6.2.3 Episode 2: Establishing the project

The project proposal was approved in December 2012 and granted 5.5 million DDK by the Danish Health and Medicine Authority. The participants in the workgroup were aware of that the project was sufficiently extensive to require a professional project

management approach. Thus the local coordination forum for the hospital of Southern Jutland's admission area (SOF I SYD) was affiliated as a steering committee. Furthermore, it was decided to employ a daily project manager to undertake the establishment of the project and the projects progression. The project manager was a part of the project group, which moreover included the medical project manager, local project managers from the municipalities and general practitioners representing the admission area. Finally, it was decided to establish several workgroups to look into different elements of the project and to ensure that the project progressed as planned within the strict timeframe. One of these groups was looking specific into the telemedicine solution. One of the main project managers elaborates, "*We were aware that this was a major project. And if it should succeed, we knew that we had to use the project method approach.*"

The telemedicine workgroup included representatives from all four municipalities in terms of both nurses and administrative personal, a consultant from the hospital who had been involved in one previous telemedicine project and the project manager. The telemedicine workgroup had 3 meetings during the establishment phase of the project from Marts 2013 to the end of May 2013, where decisions regarding the telemedicine solution were made.

6.2.4 Episode 3: Creating requirement specification

During the telemedicine workgroup meetings the needs for the telemedicine solution were discussed. Quickly, there was agreement to create a two-part focus one the telemedicine solution, one on telemonitoring and one on video conferencing.

When looking into the telemonitoring solution there was from the beginning a common understanding in the telemedicine workgroup that it should be possible to measure blood pressure, pulse and saturation and the data should be uploaded to and accessible from shared online portal. It appears through the minutes from the workgroup meetings and the requirement specification that the solution should be robust and easy to handle by senior citizens. Moreover, there was broad agreement that the solution should be easy to install and manage, as nurses had to be able to quickly move the devices around between patients. Furthermore, it was a requirement that the data

should be transferred to the portal through a wireless cellular data connection (3G), independent of the patient's geographical location. One of the nurses participating in the workgroup explains, "*I was very aware that it should be easy to use and it should preferably not give us any extra work. We discussed several things in terms that it was preferable if it could run wireless and data should be available to be seen by the general practitioner, the specialist in the hospital and by us [the nurses].* "

In all minutes and in the requirement specification the wish for an alarm is described. The solution must include a feature to set predefined thresholds for the vital values and the possibility for the nurses to receive an alarm if these thresholds are exceeded. Throughout the process of defining the requirements for the telemonitoring solution the perception of who should have access to the shared portal changed. From the first meeting it appears from the minutes that, "*It was agreed that data should be available for both the medical specialist on the hospitals, the general practitioners and the district nurses*".

However, in the minutes from the next meeting there is written, "*The portal should preferably be accessed via the municipal nurse's existing mobile device. Data must also be able to be accessed by the medical specialist via existing PCs at the hospital. If possible, the general practitioner should also have access to the portal via their PC*". This excerpt is reflected in the final requirement specification where it is written: "*The portal should preferably be accessed via the municipal nurse's existing mobile device. Data must also be able to be accessed by the medical specialist via existing PCs at the hospital. If possible, the general practitioner should also have access to the portal via her/his PC, but this is not a requirement*".

In the process of defining the needs for the telemonitoring solution issues of more organizational matters were discussed, such as who had the responsibility to follow-up on the monitored data, and how is the equipment cleaned and maintained between uses. Furthermore, it was a desire from the telemedicine workgroup that the shared portal should be able to include all patients in the project, in order to facilitate the management of all patient related data. Including both those who received telemedicine

treatment and those in the control group. Finally, it was a requirement that the telemonitoring solution lived up to the regulatory rules of data security.

When focusing on the video communication different technical solutions were discussed. It was important for the telemedicine workgroup that the solution should deliver a reliable video connection, even in areas with poor network coverage. First it was decided to purchase simple and well-proven equipment through the procurement agreement at the hospital. However, in order not to exclude any suppliers the requirements for video communication were include in the final requirement specification.

At the first meeting it appears from the minutes that the participants in the telemedicine workgroup agreed that the video solution should be accessible for both general practitioners, nurses in the municipalities and the specialists at the hospitals. However, the perception of who should have access to video communication changed on the following meeting. According to the minutes from the second telemedicine workgroup meeting the participants now agreed that the video communication should only be available for the nurses in the municipalities and the specialists at the hospitals, and it was desired that the patient was present during the video consultation. This was also apparent from the requirement specification.

During the process of identifying the needs and requirements for the elements in the telemedicine solution it was clear that the general opinion was that the video communication was not the highest priority. In the minutes from the second group meeting it is directly written, "*Tele monitoring does have the highest priority*".

The lack of faith in the video communication is supported by one of the project managers who explains, "*There were many from the beginning of the project that did not believe in the video communication and there was never anyone who has thought that it would have a key role".*

It is important to emphasize that the telemedicine solution was seen as an add-on to the main project, by the interviewees. One of the project managers elaborates, *"It was like*

the telemedicine part was squeezed into the project without there were anyone who believed in it". Seen in a retrospective perspective one of the project managers elaborates, *"To add telemedicine to a project that is already so big already is perhaps a little optimistic".*

6.2.5 EPISODE 4: TENDERING PROCESS

Prior to finding a supplier the ACCESS-project was in contact with patient@home(82). Patient@home is the largest Danish welfare technological research and innovation project, focusing on new technologies and services for special rehabilitation and monitoring of the Danish public healthcare sector. It was an agreement in the telemedicine workgroup to cooperate with patient@home. During the tendering process patient@home acted as consultants for the project and provided professional advices.

The requirement specification was handled to patient@home, who forwarded it to their cooperation partners. One of the main project managers explains, *"We did not have much time so we described what we wanted, and then forwarded patient@home it to their partners."*

6.2.5.1 TELEMONITORING

Within a short time proposals from 3 different suppliers were obtained and the companies were invited to present their solutions for the project. One of the solutions was deselected due to lack of maturity of the technology and lack of faith in that the solution could be ready for project start. One of the project managers describes, *"So there were two [Suppliers] back, one that we really liked, because their equipment was easy to use and it was very user friendly."* However, above-mentioned solution could not deliver a shared platform, which satisfied the organizational needs of the project, such as handling all data and manage the flow of patients in both the control and intervention group. This resulted in only one solution was left which satisfied the needs of the project. Both the supplier and the workgroup were pleased with the new partnership, which were reflected in their motivation for entering the partnership.

The supplier explained that they cooperated with an external partner in relation to the telemedicine solution and that the external supplier had many years of experience with

the technology used for the telemedicine solution. But viewed in a Danish context, the telemedicine solution had only been tested in an ongoing project. The supplier expresses, *"But our motivation to do it [participate in the project], is that we can see that the market is moving this way. And when we saw what the content was in this project, we thought that it matched fine with what we were trying out. It was something new we should try, where it was an elderly patient who was to be monitored at home".*

The project manager elaborates on the project's motivation for cooperating with the supplier, *"We could see that the supplier had some more projects running around the country and had a lot of experience."* One of the project managers continued by saying, *"And we were aware that we needed somewhere, where we could communicate. So that was why we ended up choosing this supplier because they had this platform. I also think that there was a really good chemistry with the representatives from the supplier who presented the solution. Further, we could see that they were able to customize the solution so we could get what we wanted".*

It was clear that the main motivation for the telemedicine workgroup for choosing the supplier mainly was because they experienced that the supplier's product was mature and well proven through other projects, and that it contained a flexibility to be adjusted to the project. Besides this the workgroup experienced a good chemistry with the supplier. Seen from the supplier's perspective the main motivation to enter the project was to test their solution in a different setting and to get some more experience within delivering telemedicine solutions.

During the tendering process the supplier made an offer to be responsible for the establishment of the mobile network solution. However, the project group found the offer too expensive, and chose to be responsible for it. The supplier was aware of the possible challenges related to establishment of a reliable connection, "*We think the technology was good. One can then say yes we knew that there was something with the network coverage in some places. And it was also slightly the reason we supported the project to be responsible for buying the mobile subscriptions to be used to it*".

6.2.5.2 VIDEO COMMUNICATION

At the beginning of the tendering process the video communication was intended as a part of the overall solution. But none of the suppliers were able to meet this demand; patient@home therefore recommended the project to separate the solutions. The telemedicine workgroup decided to explore the possibilities for video communication themself. They tested different products known in both municipalities and the region, and concluded that the quality of the video communication was very poor and unsuitable for the purpose when using the cellular network connection.

The lack of faith in the video communication and the expected challenges in relation to establishment of a usable and reliable connection resulted in that the telemedicine workgroup requested the steering committee for the video communication to be taken out of the project. From a minute from a project group meeting, it appears that the steering group encourage for the video communication still to be included in the project. *"Despite the recommendation by the project group that video communication should not be part of the project, the steering committee calls for the video communication to be included in the project".*

This resulted in that the video communication was a part of the project and the telemedicine workgroup ended up choosing the solution used in the Region. Due to the uncertainty about the video communication the solution was first purchased and ready for use shortly before the project started. The solution was chosen because it met all the security requirements for handling personal data. However, the telemedicine workgroup was aware of the challenges related to the video communication.

6.2.6 EPISODE 5: CUSTOMIZING THE TECHNOLOGY

According to the supplier the telemonitoring solution and the platform were originally designed for the purpose of being accessed by the patient and not the healthcare professionals. The supplier describes, *"We never imagined that the solution is a place to be accessed by the general practitioner or staff at the hospital".* The supplier further explains that they imagined data related to treatment are to be forwarded to the respective systems as the health professionals otherwise orient themselves in. However, due to scope of the project and limited project budget the generic

telemonitoring model was to be customized to the project. Moreover, it was due to the projects limited budget not an option that the shared portal was integrated into the existing systems.

The solution had earlier been used in one other Danish project, but had never been used for transferring data through a wireless connection, therefore the solution had to be adjusted. The solution was adjusted and the data were first sent through a Bluetooth connection to a HUB, which then forward the data through a cellular network connection to the shared portal. The platform was customized to meet two purposes, on one hand to allow healthcare professionals to access the vital values and on the other hand to act as a management tool for the purpose of managing the patient pathways and monitoring devices. One of the project managers elaborates, "*The fact that the platform was an option, was something we in relation to managing project thought could be really smart. Moreover, it was convenient for the project to be able to incorporate some questionnaires, for research purposes in the portal*". One of the project managers describes the development process as, *"It was something that slowly was developed, where we found out how we could include questionnaires and how we could follow the patient".*

One of the project managers and two nurses from each municipality had access to a test version of the platform two month prior to the project start. The project manager tells, *"We had two months with a test system before the final system was up and running. During the test period we could test it and adjust the questionnaires and all".* The test period was used to adjust the platform mainly with focus on the organizational needs related to handling the workflows. The customizing of the telemonitoring solution had to be finished and ready for use within three month. After having customized the technology to the needs of the project, adjustment of the solution followed as an ongoing process through the test period and the first period of the project start.

6.2.7 Episode 6: Education of healthcare professionals

The educational focus was mainly targeted at the healthcare workers in the municipalities. The education performed had a clinical as well as a technical perspective. The clinical education was established to improve the skills of the

healthcare workers in the municipalities, in relation to handle acute ill medical patients. The healthcare workers in the municipalities have over all been very satisfied with the clinical education, and felt that they were prepared to handle acute ill medical patients. Two of the nurses explain, "*We definitely felt prepared to take care of the patients*". One of the local project managers elaborates, *"I think these four hours of training they [municipal nurses] have received has been very good, and they have been real happy with it".*

The technical education regarding use of the telemonitoring solution took place in several steps. First, the supplier taught the project manager how to use the telemonitoring, the project manager then taught super users in the municipalities. Afterwards, the super users taught the rest of the healthcare workers in the municipalities. Due to problems handling the technology during the first period of the project, the supplier likewise visited the different municipalities and performed another teaching session directly to the nurses. At the hospitals the project manager briefly taught the doctors how to use the shared portal. The medical specialists did not receive any education directly from the supplier.

The nurses in the municipality had different perception of the teaching sessions. One of the nurses expressed frustration and tells, *"When they were demonstrating it to us, we also experienced problems with the technology".* While another nurse expresses, "*There was a man visiting who underwent actually how we should do it. It was actually ok*". Furthermore, all the nurses expressed frustration towards the user manuals, which they had first received. The nurses tell, *"Actually we did not have a proper use manual"* and, *"We got a guidance document but it was simply not to sit and go through".* This resulted in preparation of several new guidelines. Both the supplier and the local project managers produced new simplified guidelines. One of the local project managers tells, *"We drew up a new user guidance and a workshop for the nurses".* This quote is supported by one of the nurses who explains, *"Our local project manager has been really friendly, he really made user-friendly manuals. As is easy to go to, we've had them everywhere in bags and on the wall".* The new simplified guidelines were well received, and the nurses experienced that they were easier to follow than the original guidance document.

The education was influenced by a delay in the project because of a national conflict between general practitioners and the Regions. Due to delay in the project the teaching was performed one-two month before the project started. This was not considered optimal in order for the healthcare workers to remember how to handle the technology. One of the nurses explains, "*It is no use when you get training and then you first have to use it in two months*", this quote is supported from another nurse who says, *"We learned it actually a long time before we actually had to use it".* The supplier also expressed frustration in relation to carrying out the teaching so long before project start-up, *"We had a baseline of when we thought we were going to start, so we taught and made introduction to a whole lot people and then there went some time before we really got started. So we actually taught the users too early".*

During the technical education it was not decided which solution to use for video communication. The project manager explains, *"We were not quite ready with video communication part, and therefore we could not illustrate the solution*". This resulted in the healthcare professionals were not introduced properly to the video communication. A representative from each municipality were taught how to use the video communication. At the hospital the program for video communication was installed on the medical specialists' computers and the project manager demonstrated for the medical specialists how to use it. The project manager tells, "*You could just sense that they [the medical specialists] did not think it was cool to have to familiarize themselves with a new system".*

6.2.8 Episode 7: Test of technology and communication with vendor

The project was mainly tested in relation to the communication flow concerning inclusion of the patients, since both the supplier and the project team expected the technology to work as intended. The supplier explains, *"There was not made any further testing. It was not something that was requested and we though the technology was good enough*". The project manager explained, that the project group was of the opinion that the supplier had experience from previous projects where the technology worked. The customized platform was not tested on workflows involving real patients, before starting up the project. It was announced that the first couple of weeks of the inclusion

period would serve as a test period. Nevertheless, the patients included in the first couple of weeks were still included in the RCT study. The project manager explains, *"We had slightly said that the first three weeks was a trial period because we knew that we had to start up".*

During the first weeks of inclusion there were made changes in the way the devices were connected to the platform. A local project manager explains, *"The challenge was here in our care centers, if we had two rooms next to each other we risked data from one blood pressure device was mistaken for data from another device. It was thus possible to pick up the wrong signals. The supplier solved the problem so one was to pair the blood pressure device with the respective HUB by using Bluetooth*". Further, it became clear that there were a huge challenge in terms of bad cellular network coverage; these challenges were attempted handled by testing various alternative network providers. However, the problem was not solved.
During the test and adjustment period both the supplier and the local project managers in the municipality perceived the cooperation as very good. One of the local project managers explains, "*The supplier has been fantastic all around. They have been receptive to the feedback they got, and tried to correct and develop the solution so that it became better*". This is supported by the supplier who tells, "*Well, from our side, it has indeed been a really good project. I think we have had a really good communication".*

However, one of the project managers experienced some trouble communicating with a technical employee from the supplier and explains, *"There was one other from the supplier who was very technical in his language, and I had a hard time understanding what he was saying".*

Finally, it is worth mentioning that after the project had been running for two months the project manager went on maternity leave and at the same time did the primary contact at the supplier leave her job. One of the project managers assesses that these changes may have influenced the handling of the technical issues related to the project. The project manager explains, "*And then suddenly disappeared the coordinating person at the supplier the same time as I started on maternity leave, and then I sense that there has lacked some to run it on".*

7 DISCUSSION

In this discussion chapter I will view the findings in the light of the theoretical background described in chapter 3. The structure of the discussion will reflect the iterative process and the hermeneutic perspective within the evaluation of the telemedicine elements of the ACCESS-project has emerged(75). First, the use of the different telemedicine elements will be discussed separately in relation to the theory of seeing information systems in a socio-technical perspective and the characteristic determining successful telemedicine solutions(2,12). Next, the process narratives will be analyzed and discussed with respect to the theoretical approach presented by McLeod and Doolin (62), looking at the identified influences and effects caused by outcomes of the situated actions occurring during the design and implementation process. Finally, the empirical findings will be discussed concerning the different stakeholders expectations to and believe in innovative telemedicine projects and which evaluation method there may be appropriated for evaluating innovative telemedicine projects.

7.1 THE GAP BETWEEN ENITIAL EXPECTATIONS AND ACTUAL OUTCOME

To clarify the identified gap between the initial expectations and the actual outcome, the use of technology will be discussed in this subsection, based on my interpretation of the interviewed parties perception of the actual use. I have chosen to discuss the use of the different telemedicine elements separately due to the different ways the technologies have been used in the project.

7.1.1 TELEMONITORING AND THE SHARED PLATFORM

Looking at the narrative describing the use of the telemonitoring part, it appears that the actual use of the technology does not correlate with the initial expectations. As it appears in the narrative, the telemonitoring solution has been challenged in several ways, and the interviewed parties only had limited positive experiences.

The nurses in the municipalities measured vital values on all the patients both those in the control group and those in the intervention group, as a part of their work routines

assessing the patients' condition. The nurses were familiar with the medical devices and saw them as essential to carry out their work. In one of the municipalities however, it was new for nurses to use the saturation device. These nurses expressed that using the saturation device was highly relevant in their treatment of patients, resulting in that they used it on all patients. This shows that the specific technology used for measuring vital values were understood by the nurses and measuring vital values fitted well with the nurses existing work practices and had a positive impact on their way of delivering healthcare. These are all factors that are seen as essential for the technology to be adopted and normalized into a specific context(50).

However, as described in the project protocol the telemonitoring solution was intended to work as an asynchronous telemedicine service(3), including the vital values to be uploaded and stored into an online shared portal, which both the municipal nurses and the medical specialists at the hospital had access to. As evidenced by the empirical findings the use of telemonitoring solution has been challenged in different ways and the shared portal has not been used for cooperative purpose. On one hand the two major factors influencing the use of telemonitoring according to the interviewees, were technical problems related to the technology and lack of routine as a result of the few inclusions in the project. The interviewed nurses expressed, "*It is so unprofessional when you stand and struggle with it"* and, *"And so you use a lot of time getting this equipment to work, and you actually have not really time for the patient lying in bed, and it is no good*."

As emphasized by Joseph *et al.*(12), technical problems are known as a challenge when implementing telemedicine, and are needed to be adjusted for in order to make a successful telemedicine solution. Likewise, it is acknowledged that the low number of inclusions has influenced the way that the technology has been handled. However, through interpreting the empirical findings, in the context of the theory presented, I assess that the technical problems have mainly influenced the nurses' incentive to use technology and are representing one of the factors causing the gap between initial expectations and actual use. Even if there had been more patients, I assume that the municipal nurses would still have experienced the same technical problems, based on an assessment on the resources available in the project. On the other hand the

telemonitoring solution was intended as a tool for enhancing the collaboration between the nurses in the municipality and the medical specialists. As shown in the empirical findings the technology has not been used for the purpose of collaboration. The nurses tell, "*We have not had a feeling that there are anyone who has looked at the values",* this quote indicates that there are no medical specialists who have accessed the shared portal and looked at the values. Considering the complexity of a heterogeneous healthcare network and the tightly interwoven relationship between the elements constituting medical work practices(10), it can be discussed if the medical specialists lack of use of the telemonitoring is an indicator of that the telemedicine solution has not been properly implemented in order to affect the heterogeneous network which frame the clinical work practices(55).

The absent use of the telemonitoring gives reason to discuss whether the solution has supported the intended workflow and the need of the users. The nurses express, "*But we do not need it necessarily. Unless that it is the basis we cooperate from"* and, *"The problem may have been sufficiently small so we could just make an agreement on the phone. There are also cases where the specialist did not knew enough about the project to be able to test it. And I think in general, the need is not so big".* These quotes illustrate that the nurses did not experience that the telemonitoring solution corresponded to their needs nor has supported the workflow for enhancing collaborative work. According to Joseph *et al.*(12) it is necessary to identify and clearly describe issues and needs. This is supported by Obstfelder *et al.*(2) who highlight the importance of describing the local health-related challenges that the technology is intended to solve. It can be discussed whether the nurses quotations are a symptom on failed identification of the health professionals needs and the issue, which technology was intended to solve.

The elements creating the heterogeneous network that frames clinical work practices are seen as essential for healthcare workers to treat the patients(54). Considering the absent use of the telemonitoring and the nurses' quotations about the telemonitoring not supporting their workflows may indicate that the telemonitoring has not managed to become a part of the heterogeneous network framing the clinical work practice. Successful integrating of new technology into clinical work practices is according to Obstfelder *et al.*(2) characterized by a sound anchoring into established organizational

and technical structures. In the ACCESS-project the shared portal was a standalone system, which for treatment purpose only allowed the healthcare professionals to access the patients' vital values. The system was not anchored into the existing technical structures, resulting in that the nurses registered the measured vital values in as well the shared portal as in their own care system. Because of the technical problems causing manual registration in the shared portal the nurses were performing double registration. Lack of integration into already existing systems may have complicated the use of the telemonitoring data as a basis for improved cooperation and influenced the gap between initial expectations and actual use. However, it is acknowledged that integration was not possible in the project due to economic limitations.

Furthermore, the municipal nurses pointed out that when the GP had the treatment responsibility, he/she was not having access to the shared vital values, which meant that the usual channels of communication should be used instead. This may likewise support that the telemedicine solution has not matched the actual needs of the users in relation to the tested work practices. On one hand it is recognized that the fact that the GPs were not having access to the telemedicine solution was due to a limitation in the project. On the other hand, it may also reflect that in the ACCESS-project the main focus was on testing the new cooperation forms between municipality, hospital and GP, and the telemedicine solution was tested as a possible way to support the new cooperation forms. As emphasized by Berg (10), clinical work practices must be seen as heterogeneous networks of people, organizational routines, tools, documents and so on. Due to the tightly interwoven interrelationship of these elements in the clinical work practices, the introduction of a new element often will echo through out the whole heterogeneous network which frames the clinical work practice(10). When looking at the ACCESS-project there are introduced several of new elements on the same time, both the telemedicine solution and the new cooperation forms. The fact that the work practices were new and under research, emphasizes that when establishing the project it may have been difficult to predict exact how the new work practices and cooperation forms would evolved in order to describe the exact needs and challenges which the telemedicine solution was supposed to support.

7.1.2 VIDEO COMMUNICATION

The video communication was established as a synchronous telemedicine solution(3) where the medical specialists at the hospital were supposed to be able to communicate with the nurses in the municipalities and make an assessment of the patient. However, as shown in the narrative description the solution has not been used during the project. There has been a common understanding among the nurses that the solution was not available and several of the nurses express that they had forgotten about the solution. This indicates, that the solution has not been understood by the users and may have influenced that the solution has not been normalized and adopted into the work practices(50). Furthermore, the nurses point out, as it was the case with the telemonitoring solution that the video communication does not correspond to an actual need and the tested treatment offers. As mentioned above, these are factors that have been identified to affect the lack of use and may have influenced the gap between the initial expectations and actual use(2,12).

7.1.3 HOTLINE

The third element in the telemedicine solution was the hotline. The hotline can be characterized as a low-tech synchronous telemedicine solution(3), where the medical specialists and the nurses could communicate through a telephone line. As evidenced by the narrative description, the hotline differs in use from the above-mentioned technologies, by have being subject for an actual communication between municipal nurses and the medical specialists at the hospitals.

The fact that the nurses have used the hotline reflects, that in some clinical pathways they have experienced an actual need for getting in contact with a medical specialist. This may indicate that the technology was understood by the users and therefore has been more likely to be adopted than the other technologies. However, the use of the hotline has been fragmented and challenged in two ways. On one hand, in some cases when the nurses called a medical specialist, they experienced that the medical specialist did not knew about the project. This may lead to questioning whether the medical specialists have been informed about and involved sufficiently in the project, when having the theory in mind that recruitment of clinical champions(12) and teamwork (2) are essential factors to make a successful telemedicine implementation. On the other

hand the absent use of the hotline may be a symptom on, that the tested work practices are working very well. As two of the nurses tell, *"We have had an overview, the treatment plan is good and there has been no specific complications. We felt comfortable in the process we have had and therefore may not have needed the hotline ".*

Even though the use of the hotline has been limited it may not correspond that the technology has not correlated with the need of the users, but instead be a symptom on that the fundamental cooperation routines which were tested, worked as intended including that the doctor responsible for the treatment have made a thorough treatment plan, and that the nurses were well trained to take care of the patient.

7.2 SHAPING THE DEVELOPMENT AND IMPLEMENTATION PROCESS

The process analysis based on the empirical findings creates a detailed qualitative explanation of the complex and multi-dimensional process through which the development and implementation of the telemedicine elements in the ACCESS-project have emerged over time. Inspired by the theoretical approach presented by McLeod and Doolin (62), Figure 11 has been created to give an overview of the complex and multifaceted interrelationship between the situated actions. The figure visualizes, I) The various influences on the main situated actions that constituted the respective episodes, II) The direction of an influence which can be either one way or two ways, III) The outcome of the situated action and IV) The effects on subsequent episodes. Each influence or effect is categorized into one of the four socio-technical dimensions described in the theory chapter. The socio-technical influences identified in the project are dynamic rather that static, which are resulting in that they were changing and evolving over time, often in response to the influences and effects of earlier episodes. The multi-dimensional and non-linear illustration of ICT development in Figure 11 is consistent with McLeod and Doolin's (62) argument that, "*Changes have multiple causes and are to be explained more by loops than lines*". Reading Figure 11 it is important to draw attention to that the definition and delineation of effects and influences to particular situated actions are analytical decisions made by I as a researcher.

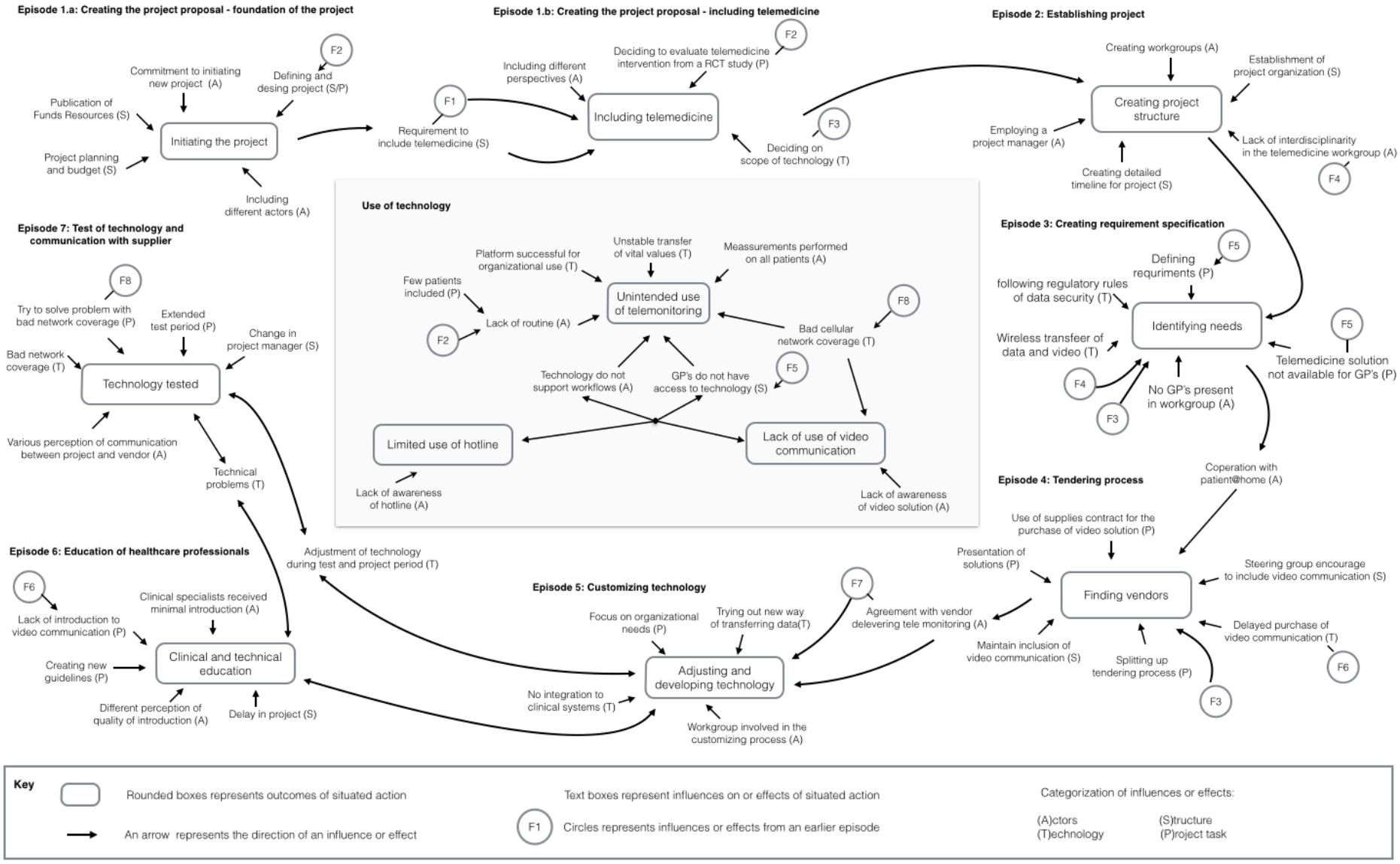

Figure 11: Illustration of the influences and effects in the ACCESS-project

7.2.1 NAVIGATING WITHIN A PREDEFINED STRUCTURAL FRAMEWORK

Episode 1.a illustrates that the ACCESS-project is based on a political initiative, where it was desired to strengthen cross-sectorial cooperation between municipalities, hospitals and general practitioners regarding subacute/acute offers for elderly medical ill patients. This entails that the project had to navigate within a predefined structural framework, resulting in that the project was carried out within a specific time as well as an economic framework. This overall structural framework has influenced the way in which the development and implementation process was shaped.

As the process narratives suggested it was according to the one of project managers, a general perception from the hospital's and the temporary workgroup's side that the project should include a form of ICT. This common perception must be seen in the light of that there was not stated in the description of the bulletin from the Danish Health and Medicine Authority that the project had to include a technology component. The fact that the hospital management encouraged the project to include a technology component in the project can be seen as a socio-technical structural element influencing the inclusion of telemedicine in the project, in terms of that the project was founded in the department for emergency research which were govern by the hospital management. When looking at the characteristic of successful telemedicine it is essential to clearly identify and describe the needs and challenges that the technology is seen as a potential solution to(2,12). Considering the actual use of the technology and the nurses' statements about that the solutions did not correspond to their needs, indicates that the decision to include technology in the project came before one had identified an actual problem as the technology was intended to solve. Unfortunately, this appears to be a key characteristic of how the development and implementation process has emerged.

In the preparation of the project proposal, the temporary workgroup determined the scope of the telemedicine solution. The fact that the temporary workgroup consisted of an interdisciplinary team is seen as a strength, in terms of including different perspectives from the users, make the technology understood by the users and to recruit clinical champions(2,12,50). However, this interdisciplinary constellation was not consistent as there later was established a specific telemedicine workgroup. There

was neither general practitioners nor representatives from the emergency departments at the hospitals in the telemedicine workgroup. The lack of interdisciplinarity may be interpreted as an unintended effect of the outcome of the situated action of creating the project structure, influencing the shaping of the following episodes. The lack of interdisciplinarity in the telemedicine workgroup is seen as a result of partly the structural framework surrounding the project and partly the fact that the telemedicine solution was not the main focus of the project, which resulted in that it was difficult to recruit the general practitioners and medical specialists to the telemedicine workgroup.

When creating the project structure it is seen as a strength that there was employed a dedicated project manager to the project (Episode 2)(12). Likewise, is the fact that the telemedicine solution was introduced as a part of a research project recognized as an advantage in order to monitor and evaluate the outcome of the intervention(12). However, when creating the project proposal it was decided by the temporary workgroup to evaluate the telemedicine solution in a RCT design, although one at this time was not aware of the technological solutions to be used in the project. As the empirical findings illustrate it was later decided to change the evaluation approach from a RCT design to a qualitative evaluation, due to the identified gap between the initial expectations and the actual use of technology. But in order to reduce the possibility of introducing bias, it was decided to maintain the randomization. One may wonder if the original study design has influenced the use of the technology. On one hand, the randomization meant that the number of patients receiving the possibility for the telemedicine intervention were limited. One the other hand it can be questioned if it would have made any difference regarding the use of technology if there were 131 patients instead of 69 patients receiving the telemedicine intervention.

7.2.2 Involved socio-technical process of negotiation

The process of creating the requirement specification is situated around identifying the needs of the users (episode 3). As illustrated in Figure 11 it is interpreted that identification of the needs is influenced by the envisioned scope of technology (F3) and the lack of interdisciplinarity in the telemedicine workgroup (F4). As shown in the empirical findings, did the perception of who should have access to the measured vital values change during the episode (episode 3). First, it was envisioned that the GPs

should have access to the shared portal, but in the final requirements specification it appears, "*If possible, the GPs should also have access to the portal via his PC, but this is not a requirement".* It is assessed that the effect of the absent involvement of GP's and the framework surrounding the project may have influenced that the GPs did not have access to telemonitoring data in the project. Furthermore, when looking at the nurses' experiences of using the technology, they emphasize that the fact that the GPs did not have access to the vital values did not correlate with the tested treatment offers. It can therefore be discussed whether the solution would have been used differently, if the GPs have had access to the measured data. On the one hand, it is unclear whether the GPs would have been willing to use the telemedicine solution as a starting point for cooperation. On the other hand, it is uncertain whether the current solution would have been able to support the work routines between the GP and the municipal nurses.

Viewing the development and implementation process in a socio-technical perspective entails to look at the interrelated elements that constitute the adoption of new technology as a whole, rather than as a technical subpart and a social subpart(52). The importance of viewing the introduction of new technology in a socio-technical perspective is underscored in episode 3, where it on one hand is discussed which technical requirements the project is having and on the other hand issues of more organizational and social origin related to who are having the responsibility to follow-up on the measured data. This approach to discuss the requirements for the telemedicine solution can according to Walsham(56) be seen as an involved socio-technical process of negotiation, which in this case is affecting the whole organization across different actors, including the healthcare professionals (non-technical actors) and technical actors (the technology in question). The people involved in the process of defining and describing the needs for the technology, makes assumptions about what competencies are required by the system as well as the users. According to Nicolini, (51) *"A large part of the designers work is that of inscribing a vision of (or prediction about) the world in the technical content of the new object."*

During the process of defining the requirements for the video communication and finding a supplier, the telemedicine workgroup became aware of that it was associated with difficulties. One of the project managers describes, "*There were many from the*

beginning of the project that did not believe in the video communication and there are never anyone who have thought that it would have a key role". This indicates that there from the beginning was a lack of faith in the technology and it was difficult to clearly describe an issue, which the video communication was intended to solve. These are both factors that contradict with the characteristics of successful telemedicine implementation(2,12). Furthermore, the telemedicine workgroup identified that it would be challenging to establish a reliable video communication due to areas with poor and unstable network connection. Based on lack of faith from the users and the identified challenges to establish a reliable video connection, the telemedicine workgroup requested the steering committee for the video communication to be taken out of the project (episode4). However, as shown in the empirical findings the steering committee called for the video communication still to be included in the project. Viewing this decision in the light of the statement from Kaplan *et al.* (57) saying, *"Some projects are undertaken for reasons other than need for the project: because requirements come down from the top, or because the project was simple to do, or because developers like the people who want the project".* It becomes apparent that the decision concerning to continue to include video communication in the project was a requirement that came from the top, which did not reflect the needs of the users. It is assessed that the lack of faith in the technology among users is reflected in the actual use of video communication, which showed that the solution has not been used in the project.

In the process of describing the requirements it was a desire from the project management that the shared portal could handle all included patients in the project in order to facilitate the management of patient related data. The desire is an example of the difficulties in creating a common understanding between the various groups involved in the design process of an ICT solution, which may be reflected in the creation of requirements as different participants might see the technology as a way to achieve their potentially contradictory goals(10). The managements desire for the portal to support the organizational needs is reflected in the tendering process (episode 4), where the project manager argues, that the reason for choosing the supplier was that they were able to adjust their solution to satisfy the organizational needs of the project.
As emphasized by Berg(10), different participants might see the technology as a way to achieve their potentially contradictory goals. This is reflected in respectively the

supplier and the project's motivation to engage in the cooperation. The supplier explains, *"But our motivation to do it [participate in the project], is that we can see that the market is moving this way. And when we saw what the content was in this project, we thought that it matched fine with what we were trying out. It was something new we should try, where it was an elderly patient who was to be monitored at home".* While one of the project managers elaborates on the projects motivation for cooperating with the supplier, *"We could see that the supplier had some more projects running around the country and had a lot of experience".* Accordingly, the two parties did not have the same understanding of the supplier's experience with the technology. On the one hand, the supplier was aware that they were testing the technology in a new framework, where they among other things should try sending data via Bluetooth and the 3G network. While on the other hand the telemedicine workgroup saw the technological solution as thoroughly tested and proven. It is unknown why this misunderstanding has accrued, but could maybe be explained by the statement by Kaplan(57), *"Healthcare requires collaboration, as does system implementation, yet there is difficulty in translating among specialties, stakeholders, clinicians, and implementers, sometimes to the point of a seeming 'culture clash'".* Nevertheless, it is reasonable to believe that this has influenced the shaping of the development and implementation process. However, despite the different perceptions of the technology, the respective parties in the project and the supplier experienced the cooperation as positive.

The misunderstanding regarding the purpose of the solution is underscored by the statement of the supplier in episode 5, *"We never imagined that the solution is a place to be accessed by the general practitioner or staff at the hospital".* The telemonitoring solution has not been developed with the aim to be a cooperative platform, but was instead intended as a place where patients could follow her/his own data. This may also indicates that the telemonitoring solution has not been ideal to support the tested cooperation forms.

7.2.3 THE TIGHTLY INTERWOVEN RELATIONSHIP BETWEEN TECHNOLOGY AND WORK PRACTICES

The three episodes comprising the customizing of technology (episode 5), education of healthcare professionals (episode 6) and test of technology and communication with supplier (episode 7) are examples of that the interrelationship between the episodes entails that changes have multiple causes and are to be explained more by loops than lines(62).

During the first process of customizing the technology (episode 5) the telemedicine workgroup had a special focus on modifying the technology to satisfy the organizational needs of the shared platform. During the adjustment period one of the project manager and two nurses from each municipality had access to a test version of the shared platform. On one hand it is seen as a positive thing that the users were included in the adjusting of technology, in order to recruit clinical champions(2,12), while on the other hand it can be questioned if the lack of involvement of the medical specialists in the adjustment process may have influenced the lack of commitment and absent use of the shared platform as a cooperation tool.

When implementing new ICT in a healthcare setting the introduction of a new element will often affect and involve the whole organization due to the tightly interwoven relationship between the elements in medical work practices(10,56). Obstfelder *et al.* (2) point out that technologies alone cannot create change and must not be seen as static entities moving from intervention through diffusion into routine. This is supported by Joseph *et al.*(12), who underscore that it among other things when implementing change in the service delivery are important to consider the training of staff and identification of clinical champions. In the ACCESS-project the training of staff can be seen from a socio-technical perspective stressing that the staff both received clinical and technical training (episode 6). Looking at the clinical training the municipal nurses felt that the training prepared them to take care of the patients. When instead looking at the technical training it has been challenged in different ways. Focusing on the telemonitoring it has on one hand been challenged by the project delay, which resulted in the healthcare professionals were introduced to the technology two month prior to project start. On the other hand the training was challenged by technical problems and difficulties in handling the technology. The focus on training was mainly

put in the municipalities, as it was the municipal nurses who were dealing with the technology on a daily basis. The municipal nurses received training several times, partly through the project manager teaching the super user, who then taught the rest of the users and partly by the supplier, who was out to teach them. While the medical specialists only was taught by the project manager. According to the empirical findings the nurses have attempted to use the technology, whereas the solution has not been used among the medical specialists. This indicates that the project has achieved a higher level of success in recruiting clinical champions among the municipal nurses than among the medical specialist. It can be argued that this reflects the involvement of the medical specialists throughout the development and implementation process, and the limited amount of training given to the medical specialists.

When looking at the video communication the healthcare professionals received limited training, influenced by the effect (F6) of the late purchase of the solution used for video communication. It can be argued that the limited training, lack of faith in the video communication, and the missing recruitment of clinical champions all are interrelated consequences and causes of the absent use of the video communications influencing the adoption in to the clinical work practices.

As evidenced in the empirical findings one of the biggest technological challenges were related to unstable network coverage. Throughout these three episodes (episode 5,6 and 7) the project was limited by and trying to solve this particular problem. The supplier tells, "*One can then say, yes we knew that there was something with the network coverage in some places. And it was also slightly the reason we supported the project to be responsible for buying the mobile subscriptions to be used to it*". Even though the supplier was aware of the unstable network coverage in some areas, it is assessed that project was not aware of the challenges related to establishing reliable network coverage throughout the admission area. This may be an example of that development and implementation of ICT applications for healthcare can be challenged by misunderstandings due to different background of participants in the project(57). When looking at the use of technology, it is clear that the project did not succeed to solve the problems related to bad network coverage. No doubt, the poor network coverage has had a major impact on the technical problems the municipal nurses experienced.

However, considering the other challenges that have been present in the study, in terms of limited commitment from the medical specialists and the shared portal's usefulness as a collaboration tool, it is debatable whether successful uploading of vital values would have impacted the actual purpose of the telemonitoring solution, which were to support cross-sectorial collaboration.

Finally, as discussed earlier, employing a dedicated project manger is identified to be a characteristic of successful implementation. In the context of the deployment of technology was the primary project manager going on maternity leave. During the maternity leave period, there were employed two temporary project managers who were responsible for the conduct of the project. The first was employed for about four months followed by the next (*I*) for eight months, before the original project manager was back from maternity leave. The change in project managers is assessed to have influenced the way the telemedicine solutions have been deployed.

7.3 To be (lieve) or not to be (lieve)

Denmark is know as one of the world-leading countries within the use of ICT in healthcare and there is a general consensus among policy makers that ICT in healthcare will contain a greater part of the delivery of future healthcare services(19). However, Denmark is still experiencing challenges related to development and implementation of new technologies and looking specific into telemedicine projects, all most all projects are run as research studies or on a local basis(7). This gives reason to discuss why it still is challenging to make successful telemedicine projects in a country recognized as one of the world-leading countries within the deployment of ICT in healthcare.

Focusing on the ACCESS-project it becomes clear that the different stakeholders in the project had contradictory expectations to and believe in the introduction of the new technology. The decision makers had a common understanding of that they had to include technology in the project as they saw it as essential to be considered for the pool of funds granted from the Danish Health and Medicine Authority. As an example of the decisions makers' incentive for introducing technology, one of the project managers elaborated, "*Again, it was the management that indicated that the video communication is incredibly popular. So we had to think it into the solution in some way so that we could*

try it out." The decision makers' common understanding of that the project should include some kind of ICT must be seen in the light of that it was not specifically written in the bulletin from the Danish Health and Medicine Authority that the project had to include technology. Seen from the supplier's perspective, their expectations when entering the project was, *"But our motivation to do it [participate in the project], is that we can see that the market is moving in this direction".* Finally, looking into the expectations from the users perspective, one of the project managers explains, *"It was like the telemedicine part was squeezed into the project without there was anyone who believed in it"* and "*There were many from the beginning of the project that did not believe in the video communication and there is never anyone who has thought that it would have a key role".* This gives reason to question what may have caused these different stakeholders' contradictory beliefs in the technology.

On one hand when developing and implementing new ICT for healthcare the visions and the assumptions, which are inscribed into the technology only comes to life when the technology are put into context of daily life(51). Considering the nurses citations about that the implemented telemedicine solutions did not correlate with their daily work practices, may reflect that the visions and assumptions made by the decision makers about the work practices were not a result of an actual identified need among the users, but instead a product of the societal expectations which may have influenced the decision to include technology in the ACCESS-project. The general societal expectations to telemedicine solutions are likewise supported by the supplier's citation telling that they see the market is moving in this direction. On the other hand, the users lack of belief in the technology reflect the complexity comprising heterogeneous healthcare work practices and the fact the nurses did not experience that the telemedicine solution supported their daily work routines. Considering the theory presented my May *et al.* (50) underscores that technologies, which are understood by the users are more likely to be normalized and adopted than those with negative impact and poor fit. This support that the poor correlation between the implemented technology and actual need may have influenced the lack of believe among the users.

An interesting perspective in the collected data is the nurses' positive believe when it comes to future use of technology in healthcare practices. They do all emphasize that

they see technology as a bigger player in future delivery of healthcare. This may also reflect the general societal expectation to that telemedicine is going to be part of the future healthcare. However, it gives reason to reflect on, if the ACCESS-project is a standalone project, or if the believes among the user might be more likely to decrease alongside with the vision moving from an abstract entity into a concrete project and the presences of complexity of the heterogeneous work practices increases?

Overall it could be interesting to address how does a project introducing an innovative telemedicine application ensure not to create a gap between initial expectations and actual outcome and contradictory believes among stakeholders. On one hand this task can be difficult as Kaplan *et al.*(57) argue to translate among different stakeholders, may lead to a 'culture clash' leading to misunderstandings which then again may lead to contradictory believes in the innovative technology. On the other hand Berg(10) emphasizes, to understand the critical aspects of designing and implementing telemedicine applications implies to pay closely attention to the relationship between technology, work context and the structuration of organizational activities in order to get a deeper socio-technical understanding of the underlying processes.

7.4 GENERATING KNOWLEDGE FROM INNOVATIVE TELEMEDICINE PROJECTS

As stated in the theory chapter, evaluation of telemedicine applications is traditionally methodologically closely anchored to the general clinical research traditions(37), classifying evidence by its epistemological strength, requiring that only evidence gained from meta-analyses, systematic reviews and randomized controlled trails (RCT) can yield strong recommendations(38). In the past decades there has been a significant increase in telemedicine applications evaluated in RCT studies, which have resulted in Krupinski and Bernard(41) saying, *"The existing body of telehealth evidence is now robust enough to create evidence-based guidelines and standards*"**.** However, it is discussed by Ekeland *et al.* (8), that despite the increasing number of RCT studies and systematic reviews on effect of telemedicine, there is still lack of high quality evidence to inform policy decision makers.

High quality evidence gained through rigorous well-designed and controlled studies is recognized as important to assess the impact of telemedicine applications(43), in order to convince healthcare professionals and policy makers about implementation(40). However, viewed from a clinical research perspective it can be challenging to generate high-quality evidence and the methods applicability are debatable. On one hand controlled studies include the technologies to be proven and have reached a static stage where they are no longer modified(60). On the other hand the rapidly developing of technology is limiting a static setup and long-term evaluations, which does not correlate with a RCT study design. Krupinski and Bernard(41) state, *"It is often argued that rigorous evaluation studies are done just as the technology becomes obsolete".* This entails that rigorous RCT studies may not be ideal considering the purpose for evaluation of innovative telemedicine projects.

Accordingly to the empirical findings the design and implementation of the telemedicine elements in the ACCESS-project have been challenged in different ways, resulting in that the project in collaboration with me as a researcher assessed it to be inappropriate evaluating the use of the telemedicine solutions in a RCT study. The fact that the nurses measured the vital values on all patients, concurrently with the telemedicine solutions were not subject for enhancing the collaboration between the municipal nurses and the medical specialists, resulted in that both the intervention group and the control group basically received the same treatment. Considering that the idea was to evaluate the solution in a RCT study does not correlate with the use of technology. Furthermore, the technology proved to be immature and was adjusted during the inclusion period, which likewise is not ideal considering a RCT design. Stoop and Berg(45) emphasize that when evaluating information and communication technology it is often impossible to disentangle the 'effect' caused by the new technology itself from the 'effect' caused by the changes in the work practices introduced by the implementation of the new technology. Thus, it can be discussed if the fact that the project were testing new ways of collaboration while at the same time testing the effect of the telemedicine applications, could have made it difficult to disentangle the 'effect' caused by the new technology itself from the 'effect' caused by the changes in the work practices introduced by the new collaborations forms.

Even though Ekeland *et al.*(43) call for more rigorous design-control studies, the ACCESS-project is an example of a research project introducing a telemedicine application, which had not reached a state where it was ready for being evaluated in a rigorous study design as a RCT. Considered the literature presented in the theory chapter by Berg(10), Zanaboni *et al.*(25) and MacFarlane *et al.*(26) it is emphasized that the adoption of telemedicine in routine healthcare has been slow, uneven and fragmented and most telemedicine projects do not make it out of the research phase and must be considered as operating failures. Thus, it is clear that the ACCESS-project is not the only project that has experienced challenges concerning the development and implementation process.

This gives reason to discuss if the focus on evaluating telemedicine applications in rigorous controlled studies overshadows the fact that most telemedicine applications are not ready for these evaluation approaches. On one hand it is acknowledged that it is important with rigorous well-designed studies to generate high quality evidence as stated by Ekeland *et al.*(43). While on the other hand alternative research methods must be considered if the technology in question is not ready to be evaluated in a rigorous design. Kairy *et al.*(9) argue, *"In order to develop an evidence base that is useful for decision-making, it is essential to pursue research that gives us a better understanding of the underlying processes when they are implemented in a real context".* A way to obtain a better understanding of the underlying processes shaping the development and implementation for innovative telemedicine projects could be to address the multifaceted changes, by applying a socio-technical evaluation perspective(62). Stoop *et al.*(45) elaborate on the challenge related to choosing the right evaluation method, "*Given the multitude of potential questions and priorities of different stakeholders, it is impossible to give a blueprint of how to proceed in designing an evaluation and selecting the proper method".* As stressed in the theory chapter, if a telemedicine application is not ready to be evaluated in a rigorous study design it is instead important to address telemedicine interventions and achievements as complex and ongoing innovations in natural settings, helping to learn from the success and failures so that the same wheel is not re-invented each and every time(43). To generate valuable knowledge from a telemedicine project it is therefore important to choose an evaluation approach, which reflects the design and implementation context.

8 CONCLUSION

In this chapter it is attempted to give the answers to the research questions based on the interpretation of the discussed empirical findings and presented theory. Due to the complexity and heterogeneous nature of healthcare practices it is not possible to give a straight answer to the objectives but the conclusion must instead be seen as summarizing of the main points to the issues discussed.

8.1 THE MEANING OF THE GAP BETWEEN INITIAL EXPECTATIONS AND ACTUAL OUTCOME

Through the empirical findings it was identified that the gap between initial expectations and actual outcome in the ACCESS-project consisted of several elements. When focusing on the telemonitoring solution the nurses in the municipality found the use of the medical devices for measuring vital values relevant for evaluating the patients' condition, and they used the medical devices on all patients both those in the intervention and in the control group. However, there was identified a gap between initial expectations and actual outcome when looking at the shared portals purpose for enhancing collaboration between the municipal nurses and medical specialists at the hospital. The shared portal was not used during the project for collaborative purposes; according to the nurses and the municipal project managers this was due to technical problems and lack of routine use caused by few inclusions in the project. Through interpretation of the empirical findings it is further assessed that the gap between intended use and actual use is mainly caused by the fact that solution did not correspond the needs of the healthcare professionals in order to support the tested workflows. Furthermore, it is interpreted that the lack of commitment from the medical specialists has influenced the use of the telemonitoring solution. Overall the actual use of the telemonitoring resulted in that both the intervention and control group received the same treatment offers.

Concerning the video communication the gap between initial expectation and actual outcome meant that the video communication was not used during the project. The nurses expressed that they did not see that the video communication as an answer to an actual need, and did not perceive the video communication to support the tested work routines.

Looking at the hotline, it has in contrast to the other telemedicine elements been subject to an actual communication between the municipal nurses and the medical specialists, which reflects that the hotline has corresponded to an actual need to some degree. However, the use of the hotline has been fragmented. The limited use of the hotline may partly be due to that the nurses experienced that the medical specialists did not knew about the project and partly be a symptom on that the traditional cooperation routines which were tested, worked as intended.

Overall, it is assessed that the main reason for the identified gap between the initial expectations to the use of technology and the actual use of technology was influenced by the fact, that the tested telemedicine solutions did not support the testes work practices, and thereby did not contribute to enhancing the cross-sectorial collaboration when treating elderly acute ill medical patients.

8.2 Shaping of the development and implementation process

With basis in the ACCESS-project it were identified which factors may shape the development and implementation process of an innovative telemedicine project. It was interpreted that the development and implementation process had been complex and challenged in several ways, resulting in the shaping of the process being multifaceted.

The project was based on a political initiative, which led to that the project had been carried out within a predefined structural framework, which is assessed to have influenced the shaping of the development and implementation process. The decision to include technology in the project was encouraged by the decision makers. Considering the absent use of the technology and the nurses' assessment that the solutions did not correspond their needs, indicated that the decision to include technology in the project came before one had identified an actual problem as the technology was intended to solve, which likewise is assessed to have influenced the development and implementation process.

In the process of establishing the project it is interpreted as a positive thing that there was employed a dedicated project manger and that the telemedicine solution was to be evaluated in a research study. However, the fact that the telemedicine solution was

included in a larger research study is assessed to have influenced that the main focus was on the structural considerations related to the new collaboration forms instead of on the use of the telemedicine solution. When establishing the project structure there was created a telemedicine workgroup, which did not include representatives from the GP's nor the medical specialists, it is interpreted that the lack of interdisciplinarity may have influenced the shaping of the development and implementation process, in terms of that the GP's did not have access to the telemedicine solutions and identified challenges in recruitment of clinical champions among the medical specialists. However, it is recognized that it was not possible to include GP's in the workgroup due to project limitations.

The process of deciding on the requirements for the telemedicine solutions can be seen as an involved socio-technical process of negotiation, where both the social and technical requirements were discussed. Through the process of deciding on the requirements, the telemedicine workgroup became aware of that there among the users were lack of faith in the video communication, and the establishing of a reliable connection was associated with difficulties. This resulted in the telemedicine workgroup requested the steering group for the video communication to be taken out of the project. However, the request was not meet by the steering committee, which called for the video communication still to be included in the project. It is interpreted that this likewise has influenced the shaping of the development and implementation process.

Another factor which is interpreted to have shaped the development and implementation process is the different stakeholders contradictory expectation towards the technology, which among others are reflected in the telemedicine workgroups decision in relation to choice of supplier. There was partly a desire for that the solution should be used for telemonitoring and partly there was a desire for that the shared portal should fulfill the organizational needs of the project. The customization of the telemonitoring solution, including the shared portal, is likewise assessed to have been influenced by the absent of the medical specialist in the telemedicine workgroup, resulting in that it only was the nurse in the municipality and the project manager who had access to the test system. Further, a factor influencing the shaping of the development and implementation process is the training of the healthcare professional,

which can be seen from a socio-technical perspective. On one hand the clinical training was perceived as positive while the technical training had been more fragmented. The main focus of the technical training was put in the municipalities while the training of the medical specialists has been limited, which also may reflect the limited involvement of the medical specialists throughout the development and implementation process. Throughout the development and implementation process, the project has been challenged by technology problems related to bad network coverage, which the project did not succeed in solving this problem.

Overall, the technological challenges, few inclusions, lack of faith in the solutions and the lack of use of the telemedicine solutions are interpreted to be both a consequence and cause of its low profile between the users, and can be seen as factors shaping the development and implementation process, indicating the process as dynamic rather than static as a result of change over time.

8.3 Different stakeholders expectation toward telemedicine systems

It appears through the empirical findings that the different stakeholders in the project had contradictory expectations to and believe in the introduction of the new technology. Both the decision makers and the supplier expressed a positive attitude towards telemedicine and its impact on future healthcare delivery, which is correlating with the general consensus among policy makers that ICT in healthcare must contain a greater part of the delivery of future healthcare services. However, the users had a less positive attitude towards the introduced technologies. This might reflect that the visions and assumptions made about the clinical work practices were not a result of an actual identified need among the users but instead a product of the societal expectations which may have influenced the decision to include technology in the ACCESS-project. Or the users lack of believe in the technology may reflect the complexity comprising heterogeneous healthcare work practices and the fact that the nurses did not experience that telemedicine solution supported their daily work routines.

Overall, it could be interesting to address how a project introducing an innovative telemedicine solution does ensure not to create a gap between initial expectations and actual outcome and the contradictory believes among stakeholders.

8.4 EVALUATING INNOVATIVE TELEMEDICINE PROJECTS

High quality evidence gained through rigorous studies is important to inform policy makers about the effectiveness of telemedicine. However, considering the nature of innovative telemedicine projects, generating high quality evidence can be challenging and the methods applicability are debatable.

The ACCESS-project is an example of an innovative telemedicine project that aims for sustainable use in a complex heterogeneous work practice. In the ACCESS-project the evaluation was first planned to take place in a RCT study design. However, due to an identified gap between initial expectation and actual outcome it was decided to change to a qualitative evaluation approach. The change of evaluation approach was influenced by that the project experienced the technology as immature causing technical problems, which resulted in that both the intervention group and the control group received the same treatment offer, which is not ideal considering evaluation in a RCT study. Further, it was discussed if the fact that the project was testing new ways of collaboration while at the same time testing the effect of the telemedicine applications, could affect that it would be difficult to disentangle the 'effect' caused by the new technology itself from the 'effect' caused by the changes in the work practices introduced by the new collaborations forms. This entails that rigorous RCT studies may not be ideal considering the purpose for evaluation of innovative telemedicine projects.

Overall, if a telemedicine application is not ready to be evaluated in a rigorous study design it is instead important to address telemedicine interventions and achievements as complex and ongoing innovations in natural settings, helping to learn from the success and failures. To generate valuable knowledge from a telemedicine project it is therefore important to choose an evaluation approach, which reflects the development and implementation context.

8.5 IMPLICATIONS OF THE STUDY

There is no doubt that new telemedicine solutions will be a part of the future healthcare service, however as emphasized in this thesis the development and implementation process of innovative telemedicine projects is complex and multifaceted. The experiences gained through the evaluation of ACCESS-project, underscores that to accomplish a successful implementation is not straightforward. The implications of the study stress that in order to increase the likelihood of achieving a successful telemedicine implementation, entail handling a multi-faceted complexity occurring in a socio-technical heterogeneous healthcare environment.

Specially, it is assessed that as long as the technology is not seen as a potential solution to a challenge, does not correspond the needs of the users and is not anchored into established organizational and technical structures, it will be challenging to achieve a successful implementation. This stress that it is important in the development and implementation process to acknowledge that introducing new telemedicine applications in healthcare are not straightforward and the different stakeholders need to be aware of the complexity encompassing the introduction of innovative telemedicine projects that aim for sustainable use in complex and heterogeneous work practices.

Finally, the implications of the study underscores that it is important to pay attention to which evaluation approach is chosen when one want to generate valuable knowledge from an innovative telemedicine project. The study illustrated that it is not applicable to evaluate an innovative telemedicine project through a rigorous RCT design but instead research methods investigating the underlying processes of the socio-technical interaction must be explored.

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